THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. . . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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ERRATA.

Page 213 line 4 from bottom *for* Maesfeldt *read* Mansfeldt.
„ 220 „ 10 „ „ *for* Zeitmuscheln *read* Leitmuscheln.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

"................ per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 79. JULY 1864.

I.—*Outline of the Geology of the Maltese Islands,* by Dr. Leith Adams, of the 22nd Regiment; *and Descriptions of the Brachiopoda,* by Thomas Davidson, Esq., F.R.S., F.G.S. &c.

[Plate I.]

THE Maltese Islands run from north-west to south-east; their long axis, including the intermediate channels, does not exceed twenty-nine miles. Malta, the most southern of the chain, is seventeen miles long by nine miles broad. Comino is two miles long by one in breadth; and Gozo, the most northern, is nine miles in length, with a breadth of about five miles. All the islands belong to one series, and, according to the latest researches, are to be considered portions of an early Miocene equivalent to the Hempstead beds in England *, and of the middle Tertiaries of the south of France, north of Italy, Doberg bei Bünde in Westphalia, and the Urchin-beds of Bonifacio and elsewhere in Corsica †.

The formations are sedimentary and marine, with a horizontal stratification, and are all conformable. The greatest thickness of the deposits equals nearly 800 feet above the sea-level. The

* Prof. E. Forbes, Proc. Geol. Soc. vol. iv. p. 232.
† Wright, on Fossil Echinodermata of Malta and Gozo, 'Ann. & Mag. Nat. Hist.' vol. xv., 1855.

dip runs from about north-east to east north-east, submerging the lowermost bed, which, on the opposite coast-line, rises fully 300 feet above the sea-level. The inclination is in a line with the Apennines and Sicilian range from the Val di Noto to Talizyi. Indications of great disturbances are shown by five great faults, four of which run in a transverse direction and parallel with one another. The most extensive downthrow traverses the entire breadth of Malta. The remaining fault proceeds in a north-west and south-east direction. There are, besides, local sinkings; and ancient sea-levels are apparent in several situations.

The mineral deposits arrange themselves, from the sea-level upwards, in the following order:—

5. Lower Limestone.
4. Calcareous Sandstone.
3. Marl.
2. Sand.
1. Upper Limestone.

The *Upper Limestone, Sand,* and *Marl* beds have been completely denuded for the eastern half of Malta and the south and north-western portions of Gozo.

The *Lower Limestone* varies in colour and mineral consistence, being either compact and semicrystalline, almost amounting to a variegated marble, of a cream-colour, and commonly known as "Gozo marble," or a white, coarse, open-grained rock, containing hard rounded nodules, simulating an oolitic grit. On the south-west coasts of Malta and Gozo, the Lower Limestone attains a height of 300 feet above the level of the sea. A few of its fossils seem peculiar to the bed, but the majority range upwards, and many throughout the entire series. Casts of a gigantic *Conus, Terebratula minor, Thecidium Adamsi,* together with *Scutella subrotunda, Operculina complanata,* an *Orbitoides,* &c. have as yet been met with only in the Lower Limestone and point of transition between this bed and the Calcareous Sandstone. Among the other organic remains common to the above and superincumbent beds may be mentioned bones of Cetaceans, teeth of *Carcharodon, Diodon, Myliobatis,* and Pycnodont fishes, several species of *Pecten, Ostrea, Echinus,* and *Cidaris,* &c.

The *Calcareous Sandstone* is granular, and not crystalline, in texture; the particles are minute, and evidently held together by the combined force of cohesion and pressure. The Lower Limestone passes into a white freestone, the latter into a light fawn-coloured rock traversed by a band of irregular-shaped horn-coloured nodules, which are firmly cemented together. Abundance of Mollusca, chiefly belonging to *Pecten,* are strewn

about among the nodules. This variety soon passes into a soft pale-coloured freestone, characterized by its disposition to split up into fragments: it contains rounded masses and bands of chert. The second nodule-bed passes through the centre portion of the deposit. The nodules are not so large as those already mentioned, and present a green colour externally, have an earthy fracture, and often contain portions of the fossils common to the bed, as if they were hardened portions of clay *. Although usually seen in bands of from 1 foot to 18 inches in thickness, these nodules may be met with in detached groups or strewn irregularly throughout this portion of the bed. The third seam of nodules, upwards of 10 feet in thickness, overlies the pale-coloured variety. It is the most extensive and fossiliferous of all the nodule-seams, and so loosely bound together as often to present the consistence of a gravel. The nodules are all more or less rounded, and seldom of large size. Bones (chiefly ribs) of Cetaceans are very common. It was in this bed that the teeth of the *Zeuglodon* were first found. A new species of *Phoca* was also lately discovered by the author. Prof. Owen has named it *P. rugosidens*. There are, besides, abundance of teeth of upwards of nine species of *Squalæ*, including the great-toothed shark, *Carcharodon megalodon*. Single specimens of the teeth of this fish have been discovered measuring $6\frac{3}{10}$ and 7 inches at their longest side. As usual, among the Mollusca the *Pecten* is the most common form. Among the Brachiopoda, *Terebratulina caput-serpentis* is sometimes found, and *T. ampulla* or *T. sinuosa*, Brocchi; but neither are by any means common in any portion of the Calcareous Sandstone. Casts of a Pteropod of the genus *Hyalea*, of the size of a small pea, are very common, not only in the nodule-beds, but throughout the deposit. The Echinodermata are well represented by abundant remains of species belonging to *Hemiaster*, *Schizaster*, *Spatangus*, &c., all which have been described by Dr. Thomas Wright, F.G.S.†

The pale-coloured variety of the Calcareous Sandstone is the most extensive portion of that bed: it is overlain by a reddish fawn-coloured sort, with a fourth nodule-bed about halfway. The same fossils are met with, including two beautiful *Scalariæ*. Nodules of iron in the form of peroxide, or, what are more common, hollow masses containing a coating of sulphur, are strewn in abundance throughout this portion of the deposit. The average thickness of the Calcareous Sandstone is fully 200 feet. It forms the surface-rock of nearly one-half of Malta and the south and south-western portions of Gozo. The transition

* The nodules have not been chemically examined.

† Ann. and Mag. Nat. Hist. ser. 2. vol. xv.

from this bed into the *Marl* is not so gradual as in the other deposits, forming often an abrupt line of demarcation between the reddish-yellow freestone and the loose clay. The latter bed varies in thickness: in the island of Gozo it is well developed, where often a thickness of from 40 to 50 feet is discernible; in other situations it thins out to a few feet. The fossil remains of the Marl are apparently not so numerous or so well preserved as in the other formations. Casts of shells are common, and often incrusted with iron, which, in the same form as just described, strews the bed in great abundance, together with quantities of lamellar gypsum. The Marl is a grey or drab-coloured clay, more or less tenacious, with lighter-coloured bands running horizontally throughout the bed. Passing upwards, we find a gradual passage into the *Sand*-bed, which is composed of a black or green-grained glistening sand, intermixed with grey-coloured calcareous particles or a reddish sand; the latter is at once characterized by the enormous numbers of the little foraminiferous shell *Heterostegina depressa*, which is met with in great abundance throughout this bed and the lower part of the one above it. The thickness of the Sand-bed, like the last, is very variable. In Gozo cliff, sections of 50 feet in thickness are not uncommon; but on the south-west coast of Malta it seems to thin out to a few feet. The fossils of the Sand-bed are both numerous and very well preserved. Teeth, bones, &c., of *Delphinus* are common. The *Squali* are well represented. Among the Mollusca, beds of *Ostrea Virleti* and *O. Deshayesii* are common; also beds of *Terebratula ampulla*, var. *sinuosa*, Brocchi, and *Megerlia truncata*. Among the Echinodermata, *Clypeaster altus* and *C. marginatus* are very common.

The passage from the Sand-bed to the *Upper Limestone* is usually gradual; sometimes it merges into a red- and black-grained Sandstone (i. e. *Heterostegina*-bed), then into a red or white limestone abounding in Corallines and characterized more or less by the quantities of *Rhynchonella bipartita, Terebratula ampulla*, var. *sinuosa*, and *Argiope decollata*. The last-named variety usually passes into a white calcareous sandstone, either compact or soft and porous, but always abounding in casts of *Pecten, Trochus, Arca, Haliotis*. The upper portion of this bed is usually an open-grained coarse rock, containing fissures and cavities lined with calcareous incrustations. The absence of the *Squali* from the middle and upper parts of the Upper Limestone we have repeatedly remarked; whereas such Echinoderms as *Brissus latus, Brissopsis Duciei*, and *Clypeaster Redii* have been hitherto only met with in this bed.

The thickness of the Upper Limestone varies; its average is calculated at 100 feet; but some portions far exceed that mea-

surement, and, considering the amount of degradation and denudation to which its surface has been exposed, the average here given is perhaps far under the original thickness of the deposit.

Description of the Brachiopoda.
By Thomas Davidson, F.R.S., F.G.S. &c.

Some short time ago, Dr. Leith Adams, who has devoted three years to the careful study of the geology of the Maltese Islands, forwarded for my examination and description a very interesting series of the Miocene Brachiopoda he had been able to assemble, which, I believe, may be referred to the following seven species:—

	I. Upper Limestone.	II. Sand-bed.	III. Marl.	IV. Calcareous Sandstone.	V. Lower Limestone.
1. *Terebratula sinuosa*, Brocchi (perhaps a variety of *T. ampulla*)	*	*	*	*	
2. *Terebratula minor*, Philippi (perhaps a small variety of *T. vitrea*)......				*	*
3. *Terebratulina caput-serpentis*, Linn. .				*	
4. *Megerlia truncata*, Linn.	*	*			
5. *Argiope decollata*, Chemnitz........	*				
6. *Thecidium Adamsi*, Macdonald......				*	*
7. *Rhynchonella bipartita*, Brocchi	*				

Of these seven species, four (nos. 2, 3, 4, & 5) are also found recent in the Mediterranean.

In 'The Geologist' for December 1862, I described and figured (pl. 24. fig. 19), under the denomination of *Waldheimia Garibaldiana*, a very fine new species which Mr. Etheridge assures me he had received from Malta; but, as not a trace of this shell has been discovered in that island, it will not be reproduced in the present paper. Through the kindness of M. Michelotti of Turin, Prof. Meneghini of Pisa, and Prof. Sequenza of Messina, I have been able to compare our Maltese specimens with those found in formations of a similar age in Italy, and am also indebted to those gentlemen for much interesting information in connexion with their local distribution*.

* Several British palæontologists are at present engaged in the study of Maltese Miocene fossils. Dr. Wright has prepared a valuable memoir on the Echinodermata. Mr. Rupert Jones has published an interesting account of the Foraminifera in the April (1864) Number of 'The Geologist,' wherein much valuable information will be found; and I am moreover informed that the Bryozoa and Corals will be shortly published.

1. *Terebratula sinuosa,* Brocchi, sp. Pl. I. figs. 1–7.

Anomia sinuosa, Brocchi, Conchiologia Fossile, vol. ii. p. 468 (1814), and (for figure) Bruguière, Encyclopédie Méthodique, tab. 239. fig. 3 *a, b* (1789).

Sp. char. Shell ovate, longer than wide, greatest width towards the middle; valves almost equally deep, uniformly convex from the beaks to about the middle of the shell, after which the dorsal valve becomes more or less prominently biplicated, with a sinus separating the two rounded ribs. In the ventral valve, a more or less apparent median elevation is margined by depressions or grooves of greater or less depth, and which correspond with the median sinus and ribs of the opposite valve; lateral marginal line forming a gentle and regular curve, which becomes more or less biplicated in front. Beak rounded, incurved, and truncated by a large circular foramen, which is partly margined by a concave deltidium; beak-ridges distinct only in the contiguity of the foramen. Surface smooth, marked only by concentric lines of growth. In the interior of the dorsal valve there is a very short simple loop, not much exceeding a fourth of the length of the valve, and confined to the posterior portion of the shell: this loop is attached by its crura to the hinge-plate, the two riband-shaped lamellæ being soon united by a transverse lamella bent upwards in the middle. Shell-structure punctured. Proportions very variable: a large specimen measured in length 3 inches, width 2 inches 7 lines, depth 1½ inch.

Obs. It is exceedingly difficult to specifically discriminate between some of the many biplicated *Terebratulæ* which occur so abundantly in the Jurassic, Cretaceous, and Tertiary formations; and I must admit that it would be impossible for me to find words wherewith to distinguish the shell under description from certain allied forms which occur in the above-named formations*.

* I have seen and possess several examples of *T. perovalis, T. intermedia, T. biplicata,* Sow., &c., which, although in all probability specifically distinct, agree very closely in external form with some examples of *T. ampulla* and *T. sinuosa.* Nor will it be out of place to remark that many specimens of *T. sinuosa* from Palazzo in Tuscany do exactly agree in size and shape with Brocchi's description and figure of *T. biplicata*; and we should have felt disposed to consider them synonymous had not MM. Saemann, Triger, and E. E. Deslongchamps assured us (in a paper read before the Geological Society of France on the 16th of December 1861) that the original specimen upon which Brocchi had founded his *T. biplicata* was derived from the Jurassic period. I, however, quite concur with what M. E. E. Deslongchamps subsequently stated, at p. 136 of his excellent monograph of the Jurassic Brachiopoda of France, viz. that the imperfect preservation of the beak of Brocchi's original (?) example of *T. biplicata,* as well as the uncertainty connected with its origin, makes it desirable that the terms *T. biplicata* and *T. indentata,* as applied by Sowerby, should be retained, and that the nomenclature should not be

Our difficulties do not here terminate; for, if we open Bronn's 'Index Palæontologicus,' we find *T. grandis*, Blum., *T. giganteus*, Schloth., *A. ampulla* and *A. sinuosa*, Brocchi, *T. Pedemontana*, Lk., *T. fragilis*, Kön., *T. spondyloidea*, Smith, *T. perforata*, Def., *T. variabilis*, Sow., *T. Sowerbyana*, Nyst, and *T. bisinuata*, Lk. (all from the Tertiary formation) given as synonyms of a single species, for which Blumenbach's name "*grandis*" is retained. It is quite evident that, if all the shells above named are not mere modifications of a single very variable species, they are at any rate very nearly related forms, and have not yet been distinguished in a satisfactory manner.

M. Meneghini of Pisa and Prof. Sequenza of Messina, who have both had ample opportunities of studying the shell under description, would feel disposed to consider it specifically distinct from *T. grandis* and *T. ampulla*, but at the same time are ready to admit that it is at times difficult to separate certain forms of *T. ampulla* and *T. sinuosa*. Brocchi himself describes a variety of *T. ampulla* in the following words:—"plicis eminentioribus, margine inferiore sinuata," which shows that one variety or modification in shape of his *T. ampulla* was, according to that naturalist, biplicated. Both the learned Italian Professors above named are, however, of opinion that *T. grandis* and *T. ampulla* are more uniformly convex and globose, and that they differ also slightly from *T. sinuosa* in the details of their loop (?).

It is, however, very possible, and even probable, that *T. sinuosa* is nothing more than a biplicated variety of *T. grandis* or of *T. ampulla*; and it was registered under the last-named denomination by the late Prof. E. Forbes and by Capt. Spratt in their descriptions of the geology and fossils of Malta. The reason why I have here retained the term *T. sinuosa* in preference to *T. ampulla* is, that, having examined a large number of middle-aged examples from Tuscany as well as from Malta, I found them all so extremely biplicated, that they differed in this respect so materially from similar specimens of *T. grandis* and *T. ampulla* I have been able to examine, as to have made me question the propriety of at present classing them all under a single denomination. It will remain also still to be determined whether the parent form may not have existed in the Cretaceous or Jurassic period; but we may at any rate assert that we are not acquainted

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thrown into fresh confusion by taking away the term *biplicata* from the well-known Cretaceous shell and giving it to the equally well-known *T. indentata*, to which Brocchi's imperfect shell is supposed to belong. Brocchi's name in connexion with *T. biplicata* should therefore in future be completely expunged, and Sowerby's well-known term *biplicata* be preserved for the Cretaceous shell.

with a single recent species which could be referred to the shell under description.

T. sinuosa is a very common fossil in the Miocene strata of the island of Malta, and was found by Dr. Leith Adams in the "Upper Limestone" (No. 1), the "Sand-bed" (2), and the "Marl-bed" (3), but most abundantly among the Coralline portions of the Upper Limestone. The shell is generally gregarious, and is met with in regular beds, but attains its greatest size and perfection in bed No. 1. It is very rare in the nodular vein of the "Calcareous Sandstone" (4), and Dr. Adams has not yet met with it in the "Lower Limestone" (5).

In Italy *T. sinuosa* has been found very abundantly by M. Meneghini in the Middle Miocene of Palazzo in Tuscany, and its occurrence in beds of a similar age in Piedmont has been noticed by M. Michelotti of Turin. In Sicily it has been found by M. Sequenza in the Miocene beds of Messina; and I believe I have seen specimens from Algeria.

2. *Terebratula minor*, Philippi. Pl. I. fig. 8.

T. vitrea, var. *minor*, Philippi.
T. minor, Suess, Ueber die Wohnsitze der Brachiopoden (1859), and Dav. Ann. & Mag. Nat. Hist. for July 1861.

Sp. char. Shell small, ovate, nearly straight in front. Valves almost equally deep, uniformly and tumidly convex, without fold or sinus. Surface smooth, marked only by concentric lines of growth. Beak small, incurved and truncated by a small circular foramen; deltidium small, proportions variable. Length 5, width 4, depth 3 lines.

Obs. The correct determination of this small shell is subject to some difficulties. It exactly resembles a Sicilian Pliocene example of *T. minor* sent to me by M. Michelotti of Turin, and bears the greatest resemblance to Prof. Sequenza's *T. affinis*.

The specific value of Philippi's *Terebratula minor* has, however, been differently viewed by some naturalists. Prof. Suess considers *T. minor* to be distinct from *T. vitrea* (it is, according to my learned Viennese friend, smaller, with stronger valves and blunt margins), and that Philippi has pointed out the differences between the two. M. Sequenza, on the contrary, seems to consider Philippi's *T. minor* as nothing more than a smaller race of *T. vitrea*, and assures me that in the last-named shell and in *T. minor* the loop is exactly the same, that is to say, short and simple, the two riband-shaped lamellæ being soon united by a transverse lamella bent upwards in the middle.

The Maltese specimens I have been able to examine have all the external shape and character of small examples of *T. vitrea*;

and we cannot be very far wrong, I think, in leaving it with *T. minor*.

I am informed by Dr. Adams that this species (in Malta) is peculiar, seemingly, to the point of transition between the "Lower Limestone" (5) and the "Calcareous Sandstone" (4), and occurs there along with *Thecidium Adamsi*. It has also been recently found by Dr. Adams in great abundance in the "lowest Limestone" in Gozo. Dr. Adams informs me also that this is no doubt the small *Terebratula* referred to by Capt. Spratt, in his valuable memoir on the geology of Malta and Gozo, as having been discovered by Earl Ducie when studying the geology of Malta for his geological map of that island.

T. minor occurs in the Miocene, Pliocene, and Pleistocene deposits of Sicily; and both it and *T. vitrea* live near the shore of that island.

3. *Terebratulina caput-serpentis*, Linn. sp. Pl. I. fig. 9.

Anomia caput-serpentis, Linn. Syst. Nat. p. 1153.

I can perceive no difference between the Maltese Miocene shell and those which occur in the Mediterranean. Dr. Adams informs me that the shell under notice is found (although rarely) in the "Calcareous Sandstone" (4). In Piedmont and Tuscany it occurs in the middle and upper Miocene, and in the Miocene, Pliocene, and Pleistocene of Sicily. I may also here mention that the British Museum possesses specimens from the Miocene of Gibraltar.

4. *Megerlia truncata*, Linn. sp. Pl. I. fig. 10.

Anomia truncata, Linn. Syst. Nat. p. 1152.

This species occurs along with *Argiope decollata* in the uppermost bed of the "Upper Limestone" (1) as well as in the "Sand-bed" (2) in the island of Malta, and is also found recent in the Mediterranean.

M. truncata is a common species in the middle and upper Miocene as well as in the Pliocene and Pleistocene of Italy and Sicily. It occurs also in the Miocene of Gibraltar.

5. *Argiope decollata*, Chemnitz, sp. Pl. I. figs. 11, 12.

Anomia decollata, Chemnitz, Conch. Cab. vol. viii. p. 96, pl. 78. fig. 705, *a* to *d*.
Anomia detruncata, Gmelin.

Perfectly characterized specimens, agreeing with the recent species now living in the Mediterranean, occur along with *Megerlia truncata*, in the "Uppermost Limestone" (1 B) and "Sand-bed" (2) of the Island of Malta. It is evidently the species named *Orthis detruncata* by Prof. E. Forbes in his "Note on the

Maltese Fossils" (Proc. Geol. Soc. vol. iv. No. 97), and appended to Capt. Spratt's memoir on the geology of the island.

A. decollata is also common in the middle and upper Miocene beds of Piedmont and Tuscany, but is rare in the Pliocene of Sienna; it occurs in the Pleistocene beds of Messina.

6. *Thecidium Adamsi*, Macdonald. Pl. I. fig. 13.

Thecidium Adamsi, J. D. Macdonald, Quart. Journ. Geol. Soc. vol. xix. p. 517 (1863); Davidson in Longman's Geol. Mag. for July 1864.

As this interesting little species has been recently correctly described and figured in detail by myself in 'Longman's Magazine,' all we need now repeat is that the shell occurs in great abundance in the upper portion of the "Lower Limestone" (5), and it is usually associated with *Orbitoides, Cidaris, Echinus, Scutella,* and other forms characteristic of the situation, and apparently never found in any of the superincumbent beds.

7. *Rhynchonella bipartita*, Brocchi, sp. Pl. I. fig. 14.

Anomia bipartita, Brocchi, Conchiologia Fossile, vol. ii. p. 466, pl. 10. fig. 7 (1814).

T——, Def. Dict. Sci. pp. 156, 182; Philippi, Enumeratio Molluscorum Siciliæ, vol. ii. tab. 18. fig. 5.

Terebratula incurva, Von Buch, Ueber Terebrateln, tab. 2. fig. 40 (1834).

Sp. char. Shell of a somewhat globosely triangular shape, generally rather wider than long, while at times the length slightly exceeds the width. Dorsal valve deeper and much more convex than the opposite one; mesial fold wide and apparent only towards the front. Ventral valve moderately convex, with a wide, square-shaped, shallow sinus beginning towards the middle of the valve and extending to the front. Beak acuminate, acute, incurved, leaning considerably over the umbo, with an elongated foramen extending from under the extremity of the beak to the umbo, and almost entirely surrounded by a deltidium. The surface is usually smooth, but on some specimens a few short ribs appear towards the frontal and lateral margins, while concentric lines of growth cover the surface. Length and breadth about equal. One Maltese specimen measured 10 lines in length and breadth, 7 in depth; but it attains larger proportions in other localities.

Obs. This very variable shell is stated by Dr. Adams to be common enough, along with *Megerlia truncata* and *Argiope decollata,* in the "Upper Limestone" (1), but is difficult to obtain entire. In Italy it occurs abundantly in the upper Miocene and Pliocene of Tuscany. In the island of Sicily it is common in the Miocene of Palermo; but, according to Prof. Sequenza, is less abundant in that of Messina.

EXPLANATION OF PLATE I.

Figs. 1 *to* 7. *Terebratula sinuosa,* Brocchi; different ages and variations in form. 7. Interior of the dorsal valve of a small specimen.
Fig. 8. *Terebratula minor,* Philippi.
Fig. 9. *Terebratulina caput-serpentis,* Linn. 9 *a.* Enlarged illustration.
Fig. 10. *Megerlia truncata,* Linn. 10 *a.* Enlarged.
Figs. 11, 12. *Argiope decollata,* Chemnitz. 11 *a.* Enlarged figure. 12. Enlarged interior view of the dorsal valve.
Fig. 13. *Thecidium Adamsi,* Macdonald. 13 *a, b.* Enlarged figures.
Fig. 14. *Rhynchonella bipartita,* Brocchi.

II.—*Contributions to an Insect Fauna of the Amazon Valley.* COLEOPTERA: LONGICORNES. By H. W. BATES, Esq.

[Continued from vol. xiii. p. 164.]

Genus HYLETTUS, nov. gen.

Body elongate-oblong, more or less depressed, free from setæ. Head, as in all the allied genera, much narrower than the thorax, with the antennæ approximated at the base; muzzle short and obtuse; lower lobe of the eyes subquadrate. Antennæ greatly elongated, sparingly furnished beneath with short bristles. Thorax uneven on the surface; lateral tubercles prominent and placed near the middle of the sides. Elytra without smooth lateral keels proceeding from the shoulders. Sterna simple. Terminal abdominal segment in the males with both dorsal and ventral plates notched or emarginated. Ovipositor of the female elongated, tubular; dorsal plate pointed, ventral truncated. Legs moderate; thighs clavate, thickly so in the males; basal joint of the posterior tarsi as long as, or longer than, the two following taken together. Fore and middle tarsi in the male dilated and fringed with hairs.

The chief character which distinguishes this group from *Nyssodrys* is the dilatation and ciliation of the anterior and (in less degree) of the intermediate tarsi in the males. Some of the larger species of *Nyssodrys* have the male anterior tarsi much broader than those of the hind legs, but in none of them are they furnished with the marginal fringe of hairs. The *Hyletti* are somewhat larger insects than the *Nyssodryes,* and the shape of their thorax is somewhat different, the lateral spines being in the form of large or distinct tubercles, and placed near the middle of the sides. The genus approaches *Acanthocinus* and *Graphisurus* (groups characteristic of North America and Europe) nearer than any we have yet passed in review.

Hylettus cœnobita, Erichs.

Leiopus cœnobita, Erichson, Consp. Ins. Col. Peruana, p. 145.

"*L.* fuscus, dense cinereo-tomentosus, supra flavo irroratus, scutello

nigro cincto: elytris puncto infra scutellum maculaque transversa atro-tomentosis, flavo cinctis, apice emarginatis, spina brevi terminatis. Long. $5\frac{1}{2}$–8 lin." ♂ ♀.

The examples which served Erichson for his description were obtained by Von Tschudi in Eastern Peru, in the same forest region where, further east, at Ega, I met with it in abundance. The elytra are sinuate-truncate at the apex, and it is only in the male that the outer angle of the truncature is produced into a spine; in the female both angles are acute. The thoracic tubercles are rather small, but stand out distinct from the sides of the thorax.

The *Ædilis griseofasciatus* of Serville (Ann. Soc. Ent. Fr. iv. p. 33), a common South-Brazilian insect, belongs to the present genus, and there are doubtless many other tropical American species yet to be added to it*.

Genus Palame, nov. gen.

Body oblong, narrow; elytra clothed with short setæ. Head not much narrower than thorax or elytra. Antennæ moderate in length, setose both above and beneath. Thorax with lateral spines extremely small and placed near the hind angles. Elytra free from ridges and lateral keels. Terminal abdominal segment with the ventral plate in the males sharply notched; ovipositor in the female not prolonged, the apical segment being only a little longer than that of the male, with the ventral plate convex and truncated, and the angles of the truncature produced. Legs stout; fore and middle tarsi dilated and fringed with hairs in the male; coxæ and under surface of body also densely hairy in the same sex.

In many points (for example, the setose elytra and antennæ, shape of thorax, and style of coloration) the curious insect forming this genus shows a near degree of relationship with the *Sporeti*, especially with *S. seminalis*. It exhibits, however, an almost equally close approximation to the *Colobotheæ*, showing that, notwithstanding the great amount of apparent difference between the elongate *Colobotheæ* and short flattened *Leiopi*,

* *Hylettus decorticans*, n. sp. Oblongus, subdepressus, griseo-fulvus, brunneo variegatus. Caput griseum. Antennæ rufescentes, articulis apice obscurioribus. Thorax inæqualis, griseo-fulvus, tuberculis lateralibus magnis conicis, mox pone medium sitis. Elytra oblonga, postice sensim attenuata (♂), apice oblique truncata, supra passim punctata, punctis basalibus granulis elevatis adjunctis, fulvo-grisea, utrinque maculis lateralibus tribus fuscis, prima elongata, obliqua, pone basin suturam fere attingente, secunda latiore pone medium, tertiaque interrupta prope apicem. Corpus subtus griseum. Pedes rufescentes, tibiis apice tarsisque nigricantibus. Long. 6 lin. ♂. *Hab.* Venezuela. Coll. Bakewell, Bates.

from which the *Sporeti* differ little, the two extremes are in reality closely bound together by connecting links, and, notwithstanding the almost endless multiplication of specific forms, have not diverged widely from a common plan of structure. The genus *Palame* is readily distinguishable from all allied genera by the hairy coxæ and sterna of the male, and the absence of ovipositor in the female.

Palame crassimanus, n. sp.

P. oblonga, subcylindrica, nigro-olivacea, sericea: thorace vittis quinque cinereis: elytris late subsinuato-truncatis, plagis cinereis nigro maculatis. Long. $3\frac{3}{4}$ lin. ♂ ♀.

Head black; forehead with three ashy lines, and outer orbits of the eyes ashy. Antennæ black, bases of joints paler, those of the fourth to the sixth joints ashy. Thorax convex, above silky black, with five ashy vittæ, the two lateral ones on each side, in some examples, being interrupted, and in others confluent. Elytra slightly narrowed from base to apex; apex broadly subsinuate-truncate, angles of the truncature obtuse, surface silky olive black, and with large ashy patches speckled with black; sides speckled with ashy tomentum: besides the setiferous punctures over the whole elytra, the basal part has a number of simple punctures. Body beneath ashy. Legs black, with ashy pile; tarsi and under surface of body naked in the female; in the male the fore and middle tarsi are dilated and fringed with hairs, and have fulvous brush-like palms, the coxæ and middle of the breast and abdomen being thickly clothed with brownish hairs.

Generally distributed throughout the Amazons region, on both sides of the river. It is found on slender branches of fallen trees in the forest. The terminal segment of the abdomen of the female is scarcely visible beyond the tips of the elytra.

Genus Toronæus, nov. gen.

Body oblong, somewhat convex. Head and thorax of nearly equal breadth, and much narrower than the elytra. Antennæ greatly elongated; joints long and slender, sparingly furnished with setæ both above and beneath. Thorax with a slight protuberance on the sides a little behind the middle, in place of the lateral spines. Elytra without setæ, and free from ridges and lateral carinæ. Terminal segment of the abdomen in the males with both dorsal and ventral plates more or less notched at the tip. Ovipositor of the females greatly elongated, and generally exserted beyond its sheath, tubular; dorsal plate of the terminal abdominal segment (constituting the sheath) slender and pointed, ventral deeply cleft at the apex. Legs moderately slender;

thighs clavate; tarsi undilated and simple in both sexes; basal joint of posterior tarsi as long as, or longer than, the three succeeding taken together.

This genus is distinguished from all the preceding by the cleft or deeply notched apex of the terminal ventral segment in the females; in this it agrees with *Graphisurus* of Kirby*, which, again, is connected by intermediate species with *Acanthocinus*, a group containing the well-known *A. ædilis*, or carpenter-beetle, an inhabitant of the wooded parts of our own island. Thus all the numerous genera of Acanthocinitæ are closely linked together; for species of *Nyssodrys* (e. g. *N. signifera*) exhibit to a slight extent the character of a cleft apex of the terminal ventral segment, and this genus leads on without any sharp line of demarcation to *Leiopus*,—showing that the European genera *Leiopus* and *Acanthocinus*, which appear to us so far asunder, are connected together by insensible gradations of form. The typical species of *Toronæus* (namely those which have no thoracic spines) are easily distinguishable from *Graphisurus*; but if the bounds of the genus be extended a little, so as to embrace a few closely allied species which have small thoracic spines†, the only difference between the two genera will be one of general form, the *Graphisuri* being much flattened, with comparatively short antennal joints, whilst the *Toronæi* have convex shapes and very slender antennæ.

1. *Toronæus figuratus*, n. sp.

T. oblongus, convexiusculus, nigro-castaneus, capite thoraceque vitta centrali ochracea: elytris litura humerali, macula magna communi ante medium antice et postice per suturam excurrente, fasciaque lata inflecta prope apicem cinereo-ochraceis. Long. 4–5 lin. ♂ ♀.

Head dark brown, sides of forehead and cheeks each with a yellowish streak, vertex with a broad central yellowish stripe. Antennæ slender, twice the length of the body in both sexes, reddish, tips of joints dusky, and bases of third to sixth joints whitish. Thorax not much broader than the head, and with a slight protuberance on each side about the middle, but no trace

* This genus comprehends the following North-American species:—

1. *G. fasciatus*, De Geer, Mém. v. p. 114, t. 14. f. 7.
   ——, Kirby, Fauna Boreali-Americana, Ins. p. 169.
   ?= *Lamia mixta*, Fabr. E. S. Suppl. 144. 26.
2. *G. obsoletus*, Oliv. Col. iv. p. 130, t. 13. f. 90.
   = *Astynomus lævicollis*, Dj. Cat.
3. *G. pusillus*, Kirby, Fauna Bor.-Americana, p. 169.

Acanthocinus atomarius (F.), of Europe, is also probably a *Graphisurus*.

† Such as *Eutrypanus tessellatus*, White, Cat. p. 372 (= *E. variegatus*, Dej. Cat.), and others, not found in the Amazons region.

of spine or tubercle; above dark chestnut-colour, silky, sides and a central vitta continuous with that of the head yellowish. Scutellum ochreous. Elytra in both sexes very slightly narrowed to three-fourths of their length, then abruptly narrowed in a curved line to the apex, which is subsinuate-truncate; surface punctured, except near the apex, dark brownish chestnut ornamented with marks of a yellowish-ashy hue; there is a small spot on each side of the scutellum, an angulated streak under each shoulder, and a large common spot a little before the middle extending along the suture both towards the base and apex, and connected with an angulated streak which touches the side on each elytron; this patch has a small blackish speck in its middle over the suture: besides these marks, the apex has on each side a flexuous streak enclosing a tooth-shaped spot of the ground-colour of the elytron. Body beneath hoary white. Legs reddish, with ashy pile; apex of thighs, tibiæ, and tarsi black.

♂ Terminal abdominal segment feebly emarginated at the apex.

♀ Ovipositor greatly elongated and exserted beyond its sheath, apical dorsal plate of its sheath pointed, ventral deeply cleft.

I met with this elegantly marked insect only at Obydos, on the Guiana side of the Lower Amazons, where it was abundant, in March 1859. It has been found also in the interior of Cayenne by M. Bar, and exists in French collections under the names of *Eutrypanus figuratus* and *E. elegans*, the former of which I have adopted.

2. *Toronæus suavis*, n. sp.

T. oblongus, convexiusculus, nigro-castaneus, capite thoraceque vitta centrali ochracea: elytris litura humerali, fascia obliqua pone medium, linea arcuata laterali prope apicem, suturaque postice cinereo-ochraceis. Long. $3\frac{1}{2}$–$5\frac{1}{2}$ lin. ♂ ♀.

Head dark brown, sides of forehead and cheeks each with a yellowish streak, vertex with a broad central yellowish stripe. Antennæ slender, reddish, tips of joints dusky, bases of third to sixth joints pale. Thorax not much broader than the head, and with a slight protuberance on each side about the middle, but no trace of spine or tubercle; above dark chestnut, silky, sides whitish, the middle traversed by a yellowish stripe continuous with that of the head. Scutellum ochreous. Elytra in both sexes gradually narrowed from base to apex, the latter sinuate-truncate; surface punctured, except towards the apex, dark brownish chestnut ornamented with yellowish-ashy marks; there is a small spot on each side of the scutellum, a patch beneath and a curved line above the shoulder, an oblique stripe beginning about the middle of each side, and extending to the

suture, connected with a lighter streak on the disk, and, lastly, a distinct arcuated yellowish line on each side near the apex; the suture near the base and apex is also bordered with yellowish ashy. Body beneath hoary white, breast and base of abdomen on each side with dark oblique stripes: abdomen sometimes reddish. Legs reddish; apical halves of tibiæ and tarsi black; basal joints of tarsi ashy.

♂ Terminal abdominal segment with dorsal and ventral plates rather deeply notched.

♀ Ovipositor greatly elongated and exserted beyond its sheath, apical dorsal plate pointed, ventral deeply and narrowly cleft.

This pretty species, which differs from *T. figuratus* by the more tapering shape of its elytra, and by the markings on the surface of the wing-cases, was met with at various places on the southern side of the Lower Amazons, and on the banks of the Tapajos, but never in abundance.

3. *Toronæus perforator*, n. sp.

T. oblongus, convexiusculus, fuscus, nigro fulvo canoque variegatus: elytris apice cinereo marginatis et fasciatis; fœminæ stylo elongatissimo. Long. $3\frac{1}{2}$–$5\frac{1}{2}$ lin. ♂ ♀.

Head velvety black, cheeks ashy, vertex with a short yellow line. Antennæ slender, more than twice the length of the body in both sexes, reddish testaceous, all the joints except the first and second with a pale ring at their bases. Thorax very little broader than the head, the sides in the middle with a slight protuberance, surface dark brown, with blackish spots on the disk and fulvous spots on the sides, a curved ashy streak below the lateral protuberance. Scutellum black. Elytra oblong, not narrowed until near the apex, at which point they are suddenly narrowed to the tip, which is obliquely truncated; surface thickly punctured, except near the apex, dark purplish brown, sides with greyish marks, and disk spotted with black, sometimes varied also with obscure greyish and fulvous streaks and spots, a more distinct but short oblique pale line existing, in all examples, on each elytron a little before the middle near the suture; the apical margin, both sutural and external, has a neat ashy border, which, being joined to a præapical fascia of the same hue, encloses a transverse blackish spot. Body beneath clothed with silky grey pile. Legs more or less reddish, with ashy and black rings.

♂ Terminal abdominal segment with dorsal plate semicircularly notched at the tip, ventral with a shallower notch.

♀ Ovipositor greatly elongated, the sheath extending more than two lines beyond the tips of the elytra; dorsal plate finely pointed, ventral cleft at the tip.

A widely distributed insect in the Amazons region, being found on the banks of the Tapajos and near Ega on the Upper Amazons. The species has also been met with by M. Bar in the interior of French Guiana. Cayenne examples agree precisely with those found at Ega; but those brought from the Tapajos are much lighter in colour, and have many tawny spots on the upper surface of the thorax and elytra, which are wanting in those of other localities.

4. *Toronæus terebrans*, n. sp.

T. oblongus, convexiusculus, fuscus: thorace antice maculis quatuor fulvis in serie transversa dispositis: elytris nigro griseoque nebulosis, medio macula communi cinerea, ante apicem linea transversa fulva. Long. 4 lin. ♂.

Head velvety black, cheeks ashy, vertex with a short ashy line. Antennæ reddish testaceous, bases of joints (except the basal two) pallid, apices dusky. Thorax very little broader than the head, the sides in the middle with a distinct conical protuberance; surface blackish, sides streaked with ashy, fore part with a transverse row of four distinct tawny spots, an obscure oblique line of the same hue extending from the base towards the disk on each side. Elytra oblong, not narrowed until near the apex, at which point they are suddenly narrowed to the tip, the latter obliquely truncated; surface thickly punctured, except near the apex, purplish brown, varied throughout with pale bluish grey and patches of a black colour, apical part clear brown (including the margins), but crossed by a thin yellowish line from lateral margin to suture. Body beneath silky ashy. Legs reddish, ringed with grey and black.

♂ Terminal abdominal segment with dorsal plate semicircularly notched at the tip, ventral with a shallower notch.

Found only at S. Paulo, Upper Amazons.

5. *Toronæus virens*, n. sp.

T. oblongus, convexiusculus, fusco sericeus, viridi micans: elytris plaga magna ante medium cinerea, apicibus canis utrinque macula transversa fusca. Long. $3\frac{1}{2}$–$4\frac{1}{2}$ lin. ♂ ♀.

Head sooty black, cheeks yellowish ashy. Antennæ reddish, bases of third to sixth joints pallid. Thorax very little broader than the head, the sides in the middle with a conical protuberance, surface dark brown, becoming green in certain lights; disk speckled with tawny ashy, sides ashy, with a brown streak. Elytra oblong, obliquely truncated, surface punctured, except at the apex; dark brown, with a large patch before the middle, and the apical region ashy, the apical spot enclosing a transverse curved blackish streak: the whole surface has a silky green

lustre in certain lights. Body beneath ashy. Legs blackish, ringed with ashy.

♂ Terminal abdominal segment with both dorsal and ventral plates deeply notched.

♀ Ovipositor projecting one line and a half beyond the tips of the elytra; ventral plate deeply notched.

A common insect on branches of fallen trees in the forest, both on the Upper and Lower Amazons.

Genus Callipero, nov. gen.

Body elongate, narrow; head and thorax of nearly equal width, and narrower than the elytra. Muzzle short, lower lobe of the eyes short, and narrower below than above. Thorax with a slight protuberance behind the middle, but free from lateral spines or tubercles. Elytra without lateral keels, clothed with short setæ. Sterna simple. Antennæ moderately elongated; third to seventh joints thickened (the seventh thicker than the rest), and densely clothed on their under surface with short setæ, besides the usual longer bristles which exist on all the joints (except the first) both above and beneath. Ovipositor of the female not exserted; terminal abdominal segment elongated and conical, with the dorsal plate pointed, and ventral truncated. Legs moderately elongated; thighs clavate; basal joint of posterior tarsi as long as the three following taken together.

This genus differs from all the genera of Acanthocinitæ known to me by the shape and clothing of the third to the seventh joints of the antennæ. In shape of body and style of coloration the species composing it might easily be mistaken for Cerambycideous insects of the genus *Rhopalophora*.

Callipero bella, n. sp.

C. elongata, capite thoraceque chalybeis, azureo vittatis: elytris purpureis, sutura azurea, maculis duabus basalibus aurantiacis: corpore subtus azureo. Long. 5 lin. ♀.

Head steel-blue, forehead dusky, cheeks grey, a pale blue vitta extending from the middle of the front to the occiput. Antennæ black. Thorax steel-blue, a narrow central vitta, and on each side a broad lateral one, pale blue. Elytra elongated, broader than the thorax, tapering to the apex, and broadly truncated; surface in the middle with three faint, smoothed, raised lines, thickly punctured towards the base, and covered with finer punctures, each emitting a longish, erect, black bristle; dark blue, changing to purple, suture and apical margin bordered with light cobalt-blue; base of each elytron with a large orange-coloured spot. Body beneath pale blue. Legs black, with grey pile.

I met with one example only of this most charming species, at S. Paulo on the Upper Amazons, where it was found sunning itself on a leaf on the banks of one of the brooks which run through the virgin forest.

Genus Cobelura, Erichson.

Erichson, Conspectus Ins. Coleop. Peruana, p. 149.

The founder of this genus likened it to *Colobothea*, mentioning as the only characters which distinguish it the depressed body and tumid mesosternum. *Cobelura*, however, differs from all the genera of the group Colobotheinæ in wanting the acute prominent shoulders and sharp lateral carinæ of the elytra which are characteristic of the group. The genus is more nearly allied to *Nyssodrys* and *Hylettus*, differing from both chiefly in the elongate-elliptical shape of the body (which assimilates the species to the *Colobotheæ*), unarmed sides of the thorax, tumid mesosternum, and small size of the lower lobe of the eyes. The only species described by Erichson is the *C. lorigera*, inhabiting the forest region of Eastern Peru, which differs greatly from the following in colours and markings.

Cobelura prolixa, n. sp.

C. elongata, subdepressa, postice paulo attenuata, olivaceo-grisea: thorace vitta lata mediana fusca, nigro marginata: elytris maculis irregularibus discoidalibus alteraque laterali majore triangulari ante apicem fuscis, leviter tricostatis. Long. $7\frac{1}{2}$ lin. ♂.

Head clothed with tawny pile. Antennæ reddish, bases of the joints pallid or ashy, apices dusky. Thorax much broader than the head, and much narrower than the elytra, convex and rounded on the sides, the broadest part being the middle; surface olivaceous or tawny ashy, the middle occupied by a broad dusky vitta bordered by black lines; there is also a dusky vitta on each side below the lateral dilatation. Elytra elongated and rather depressed; shoulders prominent, but obtuse; apex obliquely sinuate-truncate, with both angles of the truncature produced (the external one most so), sides destitute of carinæ; surface of each with three smooth costæ, the innermost only strongly pronounced, covered with minute punctures, each bearing a short bristle; dull greenish ashy, with small dark-brown specks and a larger triangular dark-brown spot on the sides near the apex. Body beneath obscure tawny; middle of breast and abdomen, and terminal segment of the latter, blackish. Legs greenish tawny; tibiæ and tarsi ringed with black. Mesosternum with a very large rounded tubercle.

♂ Terminal abdominal segment with both ventral and dorsal plates deeply notched.

I met with a few examples only of this species in the dry woods near Santarem, at the mouth of the Tapajos.

Genus Xylergates, nov. gen.

Body oblong, robust. Antennæ stout, moderately elongated, sparingly furnished with short bristles beneath. Thorax tubercular on the disk; lateral tubercles large and placed near the middle of the sides. Elytra much broader than the thorax, their deflexed sides broad and vertical, but not separated from the dorsal surface by smooth keels; surface costate and roughened by small tubercles surmounted by short bristles; apices truncated. Sterna narrow. Terminal abdominal segment in the males with dorsal and ventral plates notched. Ovipositor of the females moderately elongated, conico-tubular; dorsal plate obtuse, ventral truncated. Legs stout; thighs thickly clavate; fore and middle tarsi dilated in the males; first joint of the hind tarsi about equal to the two following taken together.

The robust forms and tubercular thoraces of the species composing this genus give them a strong general resemblance to the Acanthoderes; they are distinguished, however, by the elongate gradually thickened basal joint of the antennæ, the closure of the anterior acetabular sutures, the ovipositor of the females, and other characters. The genus is very closely related to *Eutrypanus*, no constant mark of difference existing other than the absence of smooth lateral keels proceeding from the shoulders of the elytra. From *Acanthocinus* it is distinguished by the high vertical sides of the wing-cases, the tuberculose surface of the body, and the dilated anterior and middle tarsi of the males.

Xylergates lacteus, n. sp.

X. oblongus, supra planiusculus, postice sensim attenuatus, brunneo sericeus: elytris strigis curvatis lacteis plagas griseas includentibus, apice sinuato-truncatis, angulis exterioribus productis. Long. $6\frac{1}{2}$–7 lin. ♂ ♀.

Head tawny brown. Antennæ ringed with grey and black. Thorax with large obtusely conical lateral tubercles near the middle of the sides, and with two obtuse tubercles on the fore part of the disk, besides three other smaller ones on the posterior part; surface purplish brown, silky, sides below the tubercles ashy. Elytra broad and straight at the base, thence gradually narrowed to the apex, which is somewhat broadly sinuate-truncate, the external angles of the truncature produced; deflexed sides (towards the base) thickly granulate-punctate; surface with numerous small punctures towards the base, and with four or five interrupted rows of acute blackish tubercles surmounted by short bristles, the middle ones lying along the faint

dorsal carinæ; the colour is silky purplish brown, with (on each elytron) a curved milk-white streak from the shoulders to near the apex bending towards the suture, and two obliquely transverse similar streaks near the apex, all enclosing patches of a light-grey colour and shorter milk-white streaks, the anterior curved lateral lines being connected across the suture by a thin straight line of the same hue. Body beneath tawny ashy. Legs grey, with dusky rings.

♂ Middle of breast and coxæ thickly clothed with brown pubescence. Terminal abdominal segment with ventral and dorsal plates deeply notched, the angles of the ventral notch acute, of the dorsal obtuse. Fore and middle tarsi dilated and fringed with hairs.

♀ Breast, coxæ, and tarsi simple and naked. Ovipositor projecting the length of a line beyond the tips of the elytra; dorsal plate broad and obtuse at the tip.

This elegant and rare species occurred only at Ega and S. Paulo, Upper Amazons. It has since been found also in the interior of French Guiana by M. Bar*.

Group *Colobotheinæ*.

Genus Eutrypanus (Dej. Cat.), Thomson.

Thomson, Classif. des Cérambyc. p. 13.

Char. emend. Body oblong or subelongate, above somewhat plane. Thorax with stout lateral spines or tubercles placed near the middle of the sides, above tubercled or convex. Elytra much broader than the thorax, their deflexed sides broad and vertical, and separated from the dorsal surface by a sharp keel proceeding from the shoulder; surface furnished with setæ, apices truncated. Prosternum narrow; mesosternum broad, nearly square. Terminal abdominal segment in the males more

* The following common South-Brazilian insect belongs to the genus *Xylergates*:—

Xylergates asper, n. sp. Oblongus, supra convexiusculus, postice rotundatim attenuatus, cinereo-fulvus, sericeo-brunneo plagiatus. Caput sordide fulvo-cinereum. Antennæ robustæ, breviusculæ, cinereæ, articulis apice fuliginosis. Thorax supra inæqualis, trituberculatus, fulvo-cinereus, disco plaga obscura brunnea, tuberculis lateralibus magnis acutis. Elytra oblonga, postice (♂ ♀) rotundato-attenuata, breviter oblique truncata, supra punctata, utrinque quadricostata, costis ante apicem abbreviatis, tubercula nigra hispida gerentibus; fulvo-cinerea, plaga indistincta scutellari alterisque duabus apud medium lateralibus angulatis sericeo-brunneis. Corpus subtus fulvo-cinereum. Pedes cinerei, fusco annulati. Maris pectore nudo, segmento ultimo abdominali fortiter inciso, tarsis anticis intermediisque dilatatis, nec ciliatis. Fœminæ stylo modice elongato, segmento ultimo dorsali subacuto. *Hab.* in Brasilia meridionali.

or less notched at the tip. Ovipositor of the females short, projecting but slightly beyond the tips of the elytra, and subconical in form. Legs stout; thighs strongly clavate; fore and middle tarsi of the males slightly dilated; basal joint of posterior tarsi longer than the two following taken together.

The species selected by M. Thomson as the type of this genus is the *E. nitidus* of White (Cat. Long. Col. Brit. Mus. p. 371, pl. 9. fig. 4), which he has redescribed in the 'Classification des Cérambycides' under the name of *E. Venezuelensis.* A considerable number of species will be found to associate with *E. nitidus*, the principal generic feature of which (omitted in M. Thomson's definition) is the sharp lateral keels proceeding from the shoulders of the elytra. This distinguishes the *Eutrypani* well from *Xylergates*, to which some of the species (e. g. *E. ellipticus* of Germar) are otherwise closely related. There is not, however, any positive character whereby to distinguish *Eutrypanus* from *Colobothea*; for some species, by their elongated shapes, might almost be mistaken for *Colobotheæ*, and the aberrant forms of the latter genus have lateral thoracic tubercles and fore tarsi in the males not differing from those of the intermediate legs, as in the *Eutrypani.* The best distinguishing character is probably this:—in *Eutrypanus* the lateral outlines of the head and thorax are not continuous, and therefore the fore part of the body has not that conical form which gives so peculiar a facies to the *Colobotheæ.* A less trenchant point of difference is presented by the elytra, which in the great majority of the *Colobotheæ* are nearly straight to the apex, but in *Eutrypanus* are curvilinearly attenuated before the apex.

1. *Eutrypanus nobilis*, n. sp.

E. oblongus, robustus, brunneus: thoracis lateribus late ochraceo vittatis: elytris maculis trilobis duabus communibus ochraceis, una apud medium suturali, altera majore subapicali: spinis thoracicis acutis, retrorsum spectantibus. Long. 7 lin. ♂.

Head dusky, with scant tawny pile. Antennæ twice the length of the body (♂), brown, tips of all the joints blackish, bases pallid. Thorax widened from the front to the tips of the thoracic spines, which are large, acute, and oblique, and placed behind the middle of the sides; surface convex, slightly uneven, dark brown, with a broad ochreous vitta on each side margined with black. Elytra broad at the base, gradually narrowed to near the apex, thence more abruptly narrowed; apex transversely sinuate-truncate, both angles equally and moderately produced; lateral carina extending beyond the middle of the elytra, acute, but not smooth; whole surface thickly punctured, punctures setiferous, colour dark brown mixed with tawny; over the suture

near the middle is a trilobed ochreous spot, and near the apex over the suture is a much broader but similar spot, the two connected by an ochreous sutural line. Body beneath tawny ashy. Legs moderately long; thighs abruptly and strongly clavate, dusky, with ashy pile; two basal joints of the tarsi grey.

♂ Terminal abdominal segment with dorsal and ventral plates very slightly emarginated. Fore and middle tarsi broader than those of the hind legs.

Obydos, on the Guiana side of the Lower Amazons; rare.

2. *Eutrypanus assula*, n. sp.

E. oblongus, brunneus: thorace nigro vittato, elytris nigro cinereoque strigosis: spinis thoracicis brevibus, conicis, pone medium sitis: elytris breviter oblique truncatis. Long. 4½ lin. ♀.

Head brown, vertex with two black spots. Antennæ dull reddish, bases of joints greyish. Thorax with small and conical lateral tubercles placed a little behind the middle, disk uneven, brown, the middle part with two black vittæ, the sides above the tubercles each with two short black lines, below the tubercle a broad black streak. Elytra moderately broad and convex, curvilinearly narrowed from near the base to the apex, the latter briefly and obliquely truncated; lateral carinæ moderately acute and smooth, and reaching beyond the middle of the elytra; surface and sides scantily punctured towards the base, brown, with many black and ill-defined longitudinal streaks, besides a broad indistinct ashy streak beginning at the shoulder, bending towards the suture, and then continuing, parallel to the suture, to the apex; the mode of coloration gives to the insect a striking resemblance to a small chip of bark. Body beneath dusky, with scant ashy pile. Legs reddish, ringed with ashy.

♀ Ovipositor projecting very slightly beyond the tips of the elytra; dorsal plate obtusely rounded at the tip, ventral truncated.

Banks of the Cuparí, a branch of the river Tapajos.

3. *Eutrypanus incertus*, n. sp.

E. elongatus, subangustatus, fulvo-griseus, nigro vittatus et maculatus: spinis thoracicis parvis, conicis, pone medium sitis: elytris postice attenuatis, apice breviter truncatis, nec dentatis. Long. 4½–6 lin. ♂.

Head blackish, orbits of eyes fulvous. Antennæ black or dull red, third to sixth joints ringed at the base with grey. Thorax not much broader than the head; lateral tubercles small, placed a little behind the middle; disk slightly uneven, ashy tawny, with six black vittæ, the two outermost of which are below the lateral tubercles. Elytra elongate, gradually narrowed to near

the apex, thence more abruptly narrowed, apex briefly and obtusely truncated; lateral carinæ sharp and smooth, surface faintly punctured towards the base, and covered besides with minute setiferous punctures, clothed with tawny pile, much spotted and patched with black, the apical region on each elytron being occupied by a large clear black spot margined with ashy. Body beneath ashy tawny. Legs blackish, with scant tawny clothing; tibiæ ringed with ashy; tarsi with the two basal joints grey.

♂ Coxæ and breast densely hairy, as also (in well-developed examples) the middle of the abdomen. Terminal abdominal segment with ventral plate sharply notched, dorsal moderately so. Fore and middle tarsi dilated and fringed with hairs.

Also found on the banks of the Cuparí. M. Bar has since met with it in the interior of French Guiana. The species, although having an elongated form of body like the *Colobotheæ*, does not offer the peculiar facies of that genus, owing to the different shape of the apex of the elytra.

[To be continued.]

III.—*Histological Researches on the Formation, Development, and Structure of the Vegetable Cell.* By Prof. H. Karsten.

[Continued from vol. xiii. p. 485, in which volume the Plate will be found.]

§ VIII.

Conditions of growth of *Spirogyra*.—Endogenous cell-tissue of the joint-cells, consisting of chlorophyll-vesicles and colourless secretion-cells.—Celluline present in the latter as well as in the mother cell, but consumed in the course of vegetation.

The species of the genus *Spirogyra* are usually adduced by the supporters of Mohl's theory of cell-development, together with *Cladophora glomerata*, as indubitable examples of cell-multiplication by constriction.

The difficulties attending the cultivation of these plants, together with the great delicacy and ready destructibility of the membranes of their endogenous cells, are without doubt the reason that hitherto, notwithstanding the very simple and regular structure of the plants, the presence of these cells has not been recognized; and still less has a complete knowledge of their course of development and of the production thereby of the septal walls been attained, as these cells, on account of the great sensibility of the plant to slight changes in the influences of external agents, can usually be observed directly in their growth only for short periods.

Moreover the *Spirogyræ*, like many, if not all, of their allies, are apparently incapable of assimilating pure inorganic matters

alone: they appear to require for their nutrition soluble organic compounds.

If a *Spirogyra* be allowed to grow for a considerable time in pure water, free from organic compounds and from dead or dying organisms, and its joint-cells be measured from time to time, these are found to undergo an unusual increase in length, and sometimes a certain augmentation also in width. At the same time the circular bands of chlorophyll diverge and become more oblique; their extremities, which were situated in the vicinity of the septum, or even bent inwards towards its central point, are gradually removed more and more from the septum. These extremities, and at length the chlorophyll-bands in their whole length, lose their spiral direction and become almost straight. The number and size of their component vesicles appear at first to augment, but subsequently they decrease, and in the end completely vanish. The same happens also with the nucleus. The other contents of the joint-cells grow more transparent and hyaline.

But if a small quantity of the mucilaginous juices of the same species or of some other Conferva be added to the water wherein the starved *Spirogyra* is placed, a new vital energy manifests itself, and many or all the joints are found in a short time divided by a tranverse septum into two; or, at least, this fission-process is in operation (Pl. VII. figs. 58–61 exhibit this condition after the action of endosmotic fluids). This process is repeated again and again, when the necessary supply of nitrogenous organic matter is afforded. The spiral bands of chlorophyll in the joint-cells also pursue a less oblique direction, and are so closely approximated and compressed that it is difficult to follow their course.

Nevertheless it would seem that these plants can be submitted to starving only to a certain degree, and afterwards be capable of renewing the act of cell-formation—a process which is evidently completely arrested when azotized matters are absent from the water in which they grow. Under this latter condition no growth proceeds, save in the membranes of the already existing joint-cells, their interior becoming simultaneously deprived of all secretion-matters, and especially of such as are nitrogenous in character. The chlorophyll-bands, which are stretched out quite straight when all the endogenous cells are absorbed, take on a more and more crooked direction between the inner surface of the mother cell and the outer wall of the daughter cells in proportion as the latter, departing from an ellipsoïdal, approximate to a spherical figure.

An increase or a decrease in the number of bands of chlorophyll is not caused by the change of the nutrient fluids, although

they are not quite constant in adjoining joints of the selfsame individual plant when in a normal state of nutrition; nay, even in the same joint-cell of *Spirogyra quinina,* one half is occupied by one and the other by two bands of chlorophyll.

The structure of these chlorophyll-bands, however, varies, as well as their disposition on the cell-wall. It is also dependent on the nature of the nutritive material and on the phase of development of the joint-cell, in the same way as the other organized contents of its interior.

The contents of the joint-cells of *Spirogyra* are commonly described as a fluid matter surrounded by spirally twisted bands of chlorophyll, to which, at the centre of the cell, a nucleus is suspended by means of mucous threads.

This interpretation of the structure of *Spyrogyra* labours under the same defects as the one heretofore entertained with respect to *Cladophora,* as a few experiments will prove.

In the joint-cells of *Spirogyra* we find, even with more distinctness than in those of *Cladophora,* secretion-cells of different sorts, some filled with colourless fluid occupying the central space of the cell, and others containing a greenish mucus deposited on the surface in the form of the so-called chlorophyll-bands.

The spiral bands, which are usually channelled, sometimes furnished with a median rib or keel and often with a dentate margin, are produced, according to Kützing (Phycologia Generalis, 1843, p. 275), by the laceration of a gonimic substance at first deposited on the tender growing cell in a homogeneous manner, the laceration being due to a rapid extension and growth of the cell.

Mohl (Vermischte Schriften, 1845) likewise attributes the spiral hands of *Spirogyra* to the division of formless chlorophyll composed of a delicate green jelly-like substance.

My first investigation (Wiegmann's Archiv, 1843) of the production of these chlorophyll-bands in the elongated extremities of the cells of *Spirogyra* led me to believe that they originated from cells the membranes of which became condensed around a mucoid yellowish mass, enclosing a nuclear vesicle, and that the cells so formed proceeded to elongate, whilst their mucoid contents acquired a green colour and arranged themselves with the existing spiral bands. The former part of this hypothesis is erroneous, partaking as it does of the erroneous views respecting cell-formation then prevailing. A year afterwards I pointed this out, and maintained then, as now, that the membrane did not form around the mucus, but was present from the first, investing the colourless and rather turbid mucus, which, as the cell-wall increased in thickness, acquired first a yellow and

subsequently a green hue, a new vesicle in the mean time being developed in the centre of the cell.

Kützing's hypothesis receives support from, and was probably based upon those varieties in development in which the chlorophyll-bands are in close apposition and not very oblique in direction, as seen in figs. 69 and 70, representing the *Spirogyra orthospira*, Nägeli (?) (*S. majuscula*, Kützing ?). In these examples the recognition of the limits of the several bands, and of the untenability of this view, is difficult, but it may be attained by the observation of the further development.

On cutting through a joint-cell, as shown in figs. 70 and 72, and observing the contents as soon as possible after the water first begins to act upon them, we see, according to the phase of development of the joint-cell, the extrusion from the interior of a number of larger or smaller hyaline cells; the chlorophyll-bands usually break up into several elongated or spherical cells, which swell up more or less rapidly, display one or several very thick-walled starch-vesicles imbedded in the green mucoid contents, and, on fully emerging from the joint-cell into the water, suffer collapse. On the contrary, the mucoid mass which invests the hyaline cells resists the solvent action of the water.

Some of the colourless cells are usually very much larger than the rest, two or four such being, as a rule, present in each joint-cell, one or two lying on either side of the cell-nucleus. Betwixt these, surrounding the cell-nucleus, are placed the smaller and similar cells. These structures are, in rarer instances, found at the ends of the cells near the septum (fig. 72).

In those species in which the nuclear cell multiplies simultaneously with the formation of new joint-cells, as in *Spirogyra nitida*, *S. orthospira*, &c., only one of these non-nuclear endogenous cells is enlarged on either side of the cell-nucleus; whilst in those other species, where the nucleus is little developed, two such endogenous cells are mostly to be seen on either side of it.

In fig. 72, one of these large colourless cells has been destroyed in making the section through the uppermost joint-cell in the vicinity of the septum; but the second has been considerably extended, and the smaller hyaline cells, which originally occupied the centre of the joint-cell, have been displaced by it.

The water also acts similarly, although more gradually, upon the cell next to that which has been cut through, no doubt by penetrating through the exposed septum (figs. 71 and 72). In the corresponding cell (fig. 72) one of the two large colourless cells has protruded itself at each side of the joint near the sep-

tum from beneath the chlorophyll-bands, which previously concealed them; the chlorophyll-bands are accumulated in the middle of the joint-cell, and indeed broken up into distinct small cells containing starch and chlorophyll-vesicles.

In the next joint-cell beneath, still almost unchanged, the two colourless cells (vesicles) are seen to be scarcely more distended than in the normal condition; the cell-nucleus lies between them, surrounded by smaller hyaline colourless vesicles. The chlorophyll-bands are unchanged. A similar phase is shown in fig. 64, in *Spyrogyra princeps* (*S. nitida,* Kützing).

In *Spirogyra? orthospira,* the chlorophyll-bands are always more delicate than in most other *Spirogyræ,* and are, under similar conditions, more easily broken up into their component parts. In the other species, one of these bands not unfrequently continues entire, and, whilst more or less outstretched, swells up in a saccular form, the keel-shaped thickened portion spreads out, and the starch-corpuscles, that have heretofore appeared only to adhere to the chlorophyll-bands, are then seen to be contained within the interior of the cylindrical sac so produced.

These phenomena suggest the inference that the common envelope of the chlorophyll-layer of *S. orthospira* is very thin-walled and breaks down in water, whilst the enclosed vesicles and cells possess a membrane that can resist the destructive action of the water for a longer period, and by endosmosis undergo great expansion; that, on the other hand, in other species of *Spirogyra,* in *S. decimina, S. princeps, S. quinina,* &c., the secretion-cells are enclosed by a stronger and more resistant envelope united with the chlorophyll-sac. These bodies contained within the chlorophyll-sac undergo, like a tissue-cell, the most varied endogenous development: at first only chlorophyll-vesicles, but at length thick-walled starch-corpuscles, of which in many cases only the outer enlarged envelopes finally remain, are aggregated together in the sacs like Conferva joint-cells. This intimate study of the cycle of forms these chlorophyll-sacs of the species of *Spirogyra* pass through is a necessary preliminary investigation towards a thorough apprehension of the mode of development of joint-cells.

The membrane of the secondary joint-cell is not apparent in the example shown in fig. 72; it would seem to have swollen up and to have melted away in the water at the cut end; perhaps it was in that stage of chemical metamorphosis which precedes the thickening (lignification). In the specimen represented in fig. 70, it is seen contracted upon the enclosed cell-structures; the one small twin-cell still existing here is thus covered by the chlorophyll-sacs, and hangs as by a thread to the septum of

the cell, where the primary cell-membrane is still adherent to the secondary.

If a vigorously growing *Spirogyra*, after the first operation of the diosmotic fluid has effected the complete separation of the secondary cells from the membrane of the primary, be laid in pure water, the secondary cells, with their contained tissue of cells, appear to regain their former position.

If the diosmotic fluid be allowed to effect a complete contraction of the secondary cells, and the surrounding liquid be then rapidly replaced by pure water, the secondary cells do not again expand (either from the entire exosmosis of their contents or from the rupture of their walls), but the non-nuclear daughter cells (vesicles) then break through the membrane of the secondary cell and progressively expand, the larger of them usually again entirely occupying the cavity of the mother cell, and proceed to form a septum at the middle by the juxtaposition of their walls.

In this case the same phenomena occur as mechanical effects which have been observed as the normal process of growth in the continuously developing daughter cells of *Œdogonium*. If the experiment be made with *Spirogyræ* in a state of vegetative repose, in which the endogenous cells are less developed and do not entirely fill the mother cell, then, during the exosmotic contraction of the secondary cell, its membrane is torn completely across in the middle of the two enclosed daughter cells, together with the portion of the chlorophyll-sac which is here situated.

Under such circumstances, moreover, the daughter cells, after the addition of the water, protrude from the spiral sac and those portions of the envelope of the mother cell that covered them, and proceed to expand in the manner described, constituting that condition which has hitherto been erroneously supposed to originate from fission of the secondary mother cells (figs. 78 & 79, from *S. quinina*).

These different diosmotic reactions exhibited by the several nested cells within a joint-cell are probably dependent on the different nature of their membranes, as indicated by their different degrees of thickness and firmness, and probably also on the varying quantity of their component elements, which are cognizable by no chemical distinctions.

Both the primary and secondary cells of a joint-cell, and also the non-nuclear transparent daughter cells, contain a material which is coloured blue like starch by an aqueous solution of iodine, after maceration not only with dilute solution of sulphuric acid or chloride of zinc, but also with a neutral solution of chloride of calcium. In this state it is commonly more or less slightly turbid, like finely divided starch. The contents of the primary

cell are often to be seen, soon after the action of the aqueous solution of iodine, precipitated upon the membranes, upon the other cellular contents, and separated from the wall of the primary cell by a colourless hyaline fluid; but by-and-by the gummy-looking substance diffuses itself through the whole fluid intervening between those membranes.

The colourless and non-nuclear daughter cells (vesicles) seem to contain this substance, which is coloured blue by iodine, in the most concentrated form; they are always quite filled with it. Both in them and in the gum-like contents of the mother cell, coloured blue by iodine, we may distinguish, when chloride of calcium has been employed for maceration, delicate vesicles of about the size of the large starch-vesicles which occur in the chlorophyll-sac.

This existence of organized forms as the contents of endogenous cells is of great importance for the right understanding of the nature of this material, which is in some degree similar to cellulose; for, were these vesicles not present (and they are moreover not unfrequently to be distinguished without the preparation above described, particularly within the colourless daughter cells), we should be entitled to assume that the matter interposed between the primary and secondary mother cells was an adherent layer, swollen up and chemically modified by the corroding substances, upon the internal surface of the former or on the outer surface of the latter.

Moreover, if it were impossible to recognize the delicate membrane of the secondary cells within the limits of the contracted chlorophyll-sac &c. after the blue colour fades by the evaporation of the iodine, the blue-coloured mucilaginous mass between the chlorophyll-sac and the primary cell-membrane might be regarded as the membrane of the daughter cell modified in the same way, with some of the vesicles apparently adherent to the chlorophyll-band intermixed with it.

These circumstances favour the notion that these vesicles enveloped in the gummy substance, for which I propose the name *celluline*, outside the secondary cells, are the remains of the contents of the primary joint-cell.

It is probably to the larger or smaller quantity of these contents of the primary cell, as well as to this change in the condition of aggregation of the membrane of the secondary cell, that we must attribute the circumstance that the latter, during the action of diosmotic fluids, such as glycerine and chloride of calcium, often separates with difficulty from the membrane of the primary, and appears to be glued to this as if by a tenacious mucilage.

In many stages of development, however, the membrane of

the secondary cell appears indeed to have lost its delicate though firm consistence. In such cases the chlorophyll-layer is found to be surrounded by a thick, almost gelatinous, but viscous layer, capable of being drawn out in threads, which it is often difficult to separate by endosmotic agents from the membrane of the primary cell. In this layer, which likewise exhibits the reaction of celluline, the contracting chlorophyll-sacs leave behind them the impression of their forms as furrow-like depressions (figs. 65 & 66).

This state of aggregation of the membrane of the secondary cell appeared to me to prevail especially among plants whose joint-cells were in process of multiplication.

The *Spirogyra dubia* (Kützing), represented in fig. 62, had been immersed for some time in carbonic-acid water, when the membranes of the secondary cells contracted by the action of a watery solution of iodine, but appeared altered, almost corroded, and in many cells ruptured at the ends during the contraction, by which means the endogenous cells (*a*) were enabled to escape from them. These cells contained a great abundance of the above-described celluline, which acquires a red colour by treatment with glycerine and iodine, and, in the course of the further growth of the plants in water containing carbonic acid, appears to be absorbed.

In those specimens of *Spirogyra* which have grown for a long time in pure water destitute of nitrogenous compounds, the delicate membrane of the secondary cell is completely contracted with much facility by the action of a dilute solution of chloride of calcium, and is seen to contain no endogenous cells except the chlorophyll-sacs. Moreover no celluline is discoverable, although the chlorophyll-sac still usually contains the well-known large starch-vesicles.

The membranes of the several cells are not coloured blue by the reagents above mentioned; and I observed a cellulose reaction in them, as well as in those of *Cladophora*, occasionally only, and as the exception, and then without being able to detect the circumstances upon which this condition of the cell-membrane depended.

It follows distinctly, from what has been stated, that the hypothesis that the joint-cells of *Spirogyra* are filled with a tissue of endogenous cells is perfectly well founded; for mere vacuoles in a mucilaginous material would not at one time enlarge and at another contract by diosmotic agency, nor would they possess special contents, and in these again contain cellular structures.

With respect to the nature of the two sorts of cells existing within the joint-cells of *Spirogyra*, and also with respect to

their relative position, there is an analogy with the cells of *Cladophora*; in these latter, however, the distinction is less marked.

In the case of *Spirogyra* no transitional forms are discoverable betwixt the central colourless cells and the peripheral cells or vesicles filled with chlorophyll and aggregated into or contained in a sac. Moreover these two kinds of secretion-cells are met with in all the other Confervaceæ and Desmidieæ, and it is upon their disposition in the mother cells that the peculiar marking of these organisms, which frequently serves for characterizing the genera and species, depends.

But further, these two varieties of secretion-cells occur not only in the tissue-cells of these simple plants, but also in the complex tissue of higher plants, where they take part in the assimilation of nutrient matter derived from without—the one variety, frequently colourless, containing hydrocarbons, the other, usually coloured, filled with nitrogenous compounds.

§ IX.

The structure and development of the nucleus (nuclear cell): its multiplication by endogenous cells.—Circulation of the cell-juices between the secretion-cells from the walls of the mother cell to the nucleus.

Particular attention has always been devoted to the cell-nucleus in the centre of the joint-cell of *Spirogyra*, and in this case, as elsewhere, a particular function in the multiplication of the cell has been ascribed to it.

The production of the cell-nucleus, which, in general, like that of the cell itself, is referred to the division of preexisting nuclei and to their new formation from the contents of the mother cell, and which is supposed constantly to precede the production of the membrane of the developed cells (whether this takes place by constriction of the wall of the mother cell or by free-cell formation in the cell-juice), is ascribed, in the case of *Spirogyra*, to the division of the preexistent nucleus of the mother cell.

As regards the notion of the division of the cell-nucleus, in the first place, the same error prevails in this as with respect to cell-multiplication itself. The existing nucleus is divided neither by the sudden appearance of a delicate membrane stretched across the radius of the nucleus nor by folds growing inwards from its membrane, but by the production of new cells by the side of its endogenous cell, the nucleolus, which under these circumstances itself contains a nucleolar corpuscle, and thus becomes the nucleus of the nuclear cell.

Soon after the first appearance of the daughter cells produced in the lentiform or discoid cell-nucleus, these are found at the

side of the original cell-nucleus, arranged in correspondence with the transverse diameter of the joint-cell. In the next stages of development they take up a position in accordance with the longitudinal axis of the cell within the nuclear cell, which has now become globular. A glance at figs. 81 & 83–85 will render this condition quite clear. These are nuclear cells of *Spirogyra nitida*, Kg., such as often occur in cultivated examples of this species, with their membranes distended by the action of water containing carbonic acid.

Fig. 84 shows very distinctly that the new cell-nuclei, which here contain no nucleoli, are enveloped by the outer membrane of the cell-system produced by the development of the cell-nucleus.

In fig. 85 these two new cells (the daughter cells of the entire cell-system) are still more expanded within their mother cell, so that they surround the nuclear cell lying between them, and enclose it with their contiguous membranes (as also in fig. 81).

The nuclear cell, however, still exists uninjured between them, as in fig. 84 (and fig. 83 shows another similar state of development seen from the side), although its absorption now generally begins, and at the same time a secondary cell is produced in each of the daughter cells. The daughter cells, distended by carbonic-acid water, here represented contain as yet no cellular structures, such as are ordinarily present in normally developed cells at this stage of development.

In fig. 81 a normal case is represented; a cell-nucleus is situated in the daughter cell on the wall directed towards the centre of the new joint-cell, as is the rule in *Spirogyra*, and therefore on the side opposite to the original cell-nucleus.

This cell-nucleus of the young daughter cell usually appears, in its earliest grades of development, in the form of a spherical accumulation of mucilage. In this mucilage, however, in other cases, a vesicle may be seen imbedded, and, a little later, one or rarely several nucleoli may be detected.

That the external membrane of the cell-nucleus (which, as already stated, is frequently seen, in some *Spirogyræ*, to be composed of several endogenous cells, and therefore developed into a complete cell-system) may attain, just as in *Œdogonium*, to the full size of the mother cell is shown by states such as that represented in fig. 80, which are met with occasionally, although rarely, in cultivated plants of *Spirogyra*. (Fig. 80 is drawn from a specimen which had lain for some time in carbonic-acid water; and this certainly assisted somewhat in the distention of the cell-membrane, as it also caused the primary membrane of the joint-cell to become particularly prominent.)

Not unfrequently, in a disproportionately long cell, two cell-

nuclei occur in the position usually occupied by them when the septum is half or completely lignified, although there is no trace of any such structure. In the middle between these two nuclei the third nucleus, belonging to the system of the mother cell, frequently occurs, all three enclosed within the very long and apparently nearly gelatinous membrane of their common mother cell (the original cell-nucleus), which is distinctly recognizable in a nearly round form in the conditions represented in figs. 83 & 84. This elongated nuclear cell, with its three nuclei, is also apparently attached by mucoid filaments.

This occurrence of several nuclei is to be explained by the deficiency of nitrogenous compounds in the water furnishing their nourishment, as appears from the phenomena of the development of the septum, to be referred to immediately.

In the so-called mucoid filaments which are so distinctly recognizable in many *Spirogyræ*, as for example *S. princeps* (*nitida* and *jugalis*, Kg.), I have observed a movement proceeding slowly from the periphery towards the central nucleus, and this in individuals which had been lying for a short time in water containing carbonic acid, and also in the extremities of strongly vegetating plants.

The mucoid filaments are therefore not solidified cords of plasma, excrescences from the membrane of the secondary cell, a framework for the support of the cell-nucleus floating in the middle of the cell, but a mucilaginous granular fluid, the true cell-juice, the fluid contents of the cell, in and from which the other cellular structures, both the nucleus and the vesicles containing secretion-materials, are developed.

These fluid cell-contents certainly occupy the smallest part of the cavity of the cell, which is almost completely filled by the above-described colourless vesicles (p. 27) (fig. 72), so that they are limited, in the form of a fluid intercellular matter, to the spaces left between them by the latter in cells engaged in rapid vegetation.

Schleiden saw this movement of the cell-juice in the extremities of *Spirogyræ*, and supposed that the same took place in the mucoid filaments, in which it was subsequently observed by Nägeli; Kützing, on the contrary, threw doubt upon it in both cases.

The cause of this circulation of the juice of many vegetable cells is very probably to be found in the concurrent lively but chemically different assimilative energy of the membranes of these tissue-cells and of the secretion-cells (the so-called vacuoles) contained in them.

That the latter are true cells, and not mere water-filled cavities of the mucilaginous cell-juice, I have already endeavoured to

prove by their development (De Cella vitali, 1843, pp. 30–34; Bot. Zeit. 1843, p. 457, and 1849, p. 361), and have here demonstrated, I think, as regards those occurring in the Confervæ.

The evident function of these cells, which are constantly engaged in a brisk exchange of materials and in rapid development, is the conversion into new and higher organic compounds, both of the material secreted inwards by the assimilating membrane of the tissue-cells to which they belong, and of that mechanically admitted from the surrounding medium by this imbibitory and diosmotic membrane. In favour of this supposition is the fact that the different vesicles which are enclosed within a single cell contain very diverse materials, usually all quite different from the fluid contents of the cell.

I have already called attention to this circumstance in my memoir 'De Cella vitali' with reference to the development of those vesicles which contain colouring-matter, starch, oil, &c., the cellular nature of which, however, is generally recognized.

But why should the vesicles which contain colourless matters, partly in aqueous solution (sugar, mucilage, dextrine?, celluline, &c.), be regarded as something different from cells? Their membrane has physical properties similar to those of recognized cell-membranes; its development is the same; and it increases in size in the same manner, a mutual relation of its proper augmenting substance to its contents being recognizable.

We are not justified in giving the name of a cell only to those elementary organs whose membrane in a certain state of development exhibits the reaction of cellulose, as indeed is proved by the Confervæ just referred to, even if we leave out of consideration the cells of the animal organism. The idea of the cell is anatomical, and is to be deduced from the mode of development of the organization, and not from the chemical nature of the material of which its membrane is composed.

The transitory cells contained in the tissue-cells undoubtedly serve for the elaboration of all the constituents of the cell-juice (*their* intercellular substance), which they are capable of assimilating; and when they have fulfilled this task, they are themselves in turn liquefied and used as nutriment by other neighbouring similar organizations, or even by the membrane of their mother cell. This product of the solution of these secretion-cells is also carried out from the cell by exosmose (?), and conducted, in the general nutritive fluid, which imbues the intercellular spaces, the outermost membranes in process of resorption, and the intercellular substance of the tissue-cells which is produced from this, into distant parts of the organism, to serve there for the formation and development of new elementary organs.

When we see all these various simple organizations engaged in rapid development and progressive growth at the expense of the fluid cell-contents, we are led to the supposition that, under such conditions, this cell-juice cannot be of exactly the same nature in the different regions of the cell, but that the fluid occupying the periphery of the cell-cavity, and secreted by the assimilative cell-membranes, will be physically and chemically different from that surrounding the vesicles which assimilate the nitrogenous compounds, and, again, that it will be differently constituted in the vicinity of those which appropriate compounds rich in carbon.

It is only by this supposition that a movement of the cell-juice appears to be explicable. This is the movement which was discovered by Corti in 1774, and which we must still regard as wonderful so long as we do not recognize the true nature of the cell-contents, but believe that the cell-juice separates into a denser and a thinner portion, that the latter is diffused through the former in the shape of drops, and that the denser mucilaginous fluid circulates between the watery drops without mixing with them! This would be to transfer to the cell Grew's notion of the structure of the tissue of plants, which, after the lapse of 200 years, has fortunately been overthrown.

There is, however, no doubt that the mucoid filaments by which the nucleus appears to be suspended are the fluid and frequently granularly mucilaginous contents of the tissue-cell, moving gently among colourless, non-nucleated cells. The form of these filaments is therefore equally variable with that of the cells themselves. With the increasing enlargement of the two daughter cells produced in the cell-nucleus, or of the two large colourless secretion-cells from the ends of the cell towards its middle point, this system of filaments changes continually, and thus indicates the changes which are taking place in the otherwise recognizable cells of which they occupy the interspaces.

[To be continued.]

IV.—*Descriptions of Seven new Species of East-Indian Spiders received from the* Rev. O. P. Cambridge. By John Blackwall, F.L.S.

Tribe Octonoculina.

Family Lycosidæ.

Genus Sphasus, Walck.

Sphasus lepidus.

Length of the female $\frac{1}{3}$rd of an inch; length of the cephalo-

thorax $\frac{1}{8}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{23}{48}$; length of a leg of the third pair $\frac{1}{3}$.

The cephalothorax is somewhat compressed before, rounded on the sides, glossy, convex, particularly in the posterior region, with a slight indentation in the medial line, and some short, strong, black hairs on each side of its base; it is of a yellowish-red colour, a fine black line extending from each eye of the anterior pair to the frontal margin, which has a dark brown spot on each exterior angle. The falces are powerful, subconical, and vertical; the maxillæ are long, obliquely truncated at the extremity, on the outer side, and slightly inclined towards the lip, which is broader towards the extremity than at the base, and truncated at the apex; the sternum is heart-shaped, and thinly clothed with short, light-coloured, and long, erect, brownish hairs; the legs are slender, and provided with hairs and long spines; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base; the palpi are short, and have a curved pectinated claw at their extremity. These parts have a dull yellowish hue; a black line extends along the inferior surface of the femoral joint of the legs, those on the femora of the posterior pair being the least conspicuous; and a fine longitudinal line of the same hue occurs on each falx in front, which lines appear like a prolongation of those on the frontal margin. The eyes are seated on black spots on the anterior part of the cephalothorax; the four posterior ones form a strongly curved transverse row, whose convexity is directed backwards, each lateral eye being placed on a minute tubercle; the other four describe a trapezoid whose shortest side is before; the posterior eyes of the trapezoid are the largest, and the anterior ones much the smallest of the eight. The abdomen is oviform, somewhat pointed at the spinners, convex above, and projects a little over the base of the cephalothorax; it is of a yellowish-grey colour, finely reticulated with pale brown; a brown band extends along the middle of the upper part to the anus, having a minute point on each side, near its anterior extremity, which is the darkest; the sides are marked with oblique dark brown lines, more or less confluent, which are most conspicuous on their posterior half; and a broad band of the same hue, having whitish scale-like hairs on each side of it, extends along the middle of the under part, and tapers to the spinners; the posterior margin of the sexual organs, which are well developed, is prominent, but obtuse, and their colour is brownish black, that of the branchial opercula being dull yellow.

Family Thomisidæ.

Genus Thomisus, Walck.

Thomisus tuberosus.

Length of the female $\frac{2}{5}$ths of an inch; length of the cephalothorax $\frac{1}{6}$, breadth $\frac{3}{20}$; breadth of the abdomen $\frac{1}{5}$; length of an anterior leg $\frac{11}{24}$; length of a leg of the third pair $\frac{1}{4}$.

The abdomen is somewhat depressed, broader at the posterior than at the anterior extremity, rather pointed at the spinners, and projects over the base of the cephalothorax; the upper part is of a pale olive-brown colour; the sides are marked with brownish black, which extends to the upper surface near its middle and anterior extremity; the under part is of a dull yellow hue, and is marked with four longitudinal rows of minute punctures, the two intermediate ones, which converge towards the spinners, being the most conspicuous; a broad, brownish-black mark, trifid at its extremity, and sending off a lateral branch immediately below each branchial operculum, occupies the middle space; the sexual organs are minute and of a dark reddish-brown hue, that of the branchial opercula being brown; on the upper part, sides, and front, there are about forty glossy tubercles, which differ in size and colour; three, situated on each side of the medial line, are disposed in pairs, the two intermediate ones being the largest and lightest-coloured; and immediately behind those of the anterior pair, which are oval and of a dark reddish-brown hue, there is a conspicuous pair of depressed spots; the largest tubercles constitute two pairs, united at their bases, situated on the upper part of the posterior half of each side, and below them there are two small ones of a dark reddish-brown hue; the prevailing colour of the tubercles is yellow-brown. The cephalothorax is large, convex, glossy, slightly compressed before, rounded on the sides, broadly truncated in front, depressed in the anterior and abruptly so in the posterior region, and is provided with minute tubercles in the medial line and on the sides; it is of a brown colour, a broad space extending along the middle having a yellowish tinge; the lateral margins and an irregular mark on each side of the medial line of the posterior slope have a yellowish-white hue. The eyes are disposed on the anterior part of the cephalothorax in two transverse curved rows, forming a crescent whose convex side is before; the lateral eyes, which are seated on tubercles, are larger than the intermediate ones, those of the anterior row being the largest of the eight. The falces are short, strong, cuneiform, and vertical; and the maxillæ are inclined towards the lip, and somewhat pointed at the extremity. These organs

are of a yellow-brown colour, the former, which are the paler, having an irregular, transverse, yellowish-white spot near their base. The lip is triangular, but rounded at the apex, and, with the heart-shaped sternum, is of a dark brown colour. The legs are provided with hairs and spines, two parallel rows of the latter extending along the inferior surface of the tibiæ and metatarsi of the first and second pairs, which are much longer and more robust than the third and fourth pairs; the first pair is rather longer than the second, and the third pair is the shortest; each tarsus is terminated by two curved pectinated claws; the coxæ have a dark brown hue; the femora, genua, and base of the tibiæ of the first and second pairs are of a pale yellowish-white colour, the femora of the former being marked on the upper surface, and those of the latter on the upper and under surfaces, with dark brown; the femora, genua, and base of the tibiæ of the third and fourth pairs have a yellow-brown hue, with a few dark brown marks on their upper and under surfaces; the anterior part of the tibiæ and the metatarsi of all the legs are of a brownish-black colour, and the dark brown tarsi have a yellowish-white hue at their base. The palpi are short, and have a small, curved, pectinated claw at their extremity; the humeral and cubital joints are of a yellow-brown colour, their under part and extremity having a yellowish-white hue; and the radial and digital joints are of a brown colour, the former being much the palest at its base underneath.

Genus Pasithea, Blackw.

Pasithea elegans.

Length of the female $\frac{1}{2}$ an inch; length of the cephalothorax $\frac{1}{5}$, breadth $\frac{3}{20}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{9}{10}$; length of a leg of the third pair $\frac{7}{10}$.

The eyes are unequal in size, encircled with pale yellow hairs, and are disposed in three transverse rows on a slight black prominence situated at the anterior part of the cephalothorax, high above the frontal margin; two, constituting the anterior row, are much the smallest of the eight, and near to each other, but not in contact; the two largest form the intermediate row; and the other four constitute the posterior row, which is curved and has its convexity directed backwards; the entire group describes a sector of a circle whose radii converge towards the frontal margin. The cephalothorax is convex, broadly truncated in front, compressed before, and somewhat rounded on the sides, which are marked with slight furrows converging towards a narrow longitudinal indentation in the medial line; it is of a red-brown colour, and is clothed with brown-red and yellowish

hairs intermixed, and a dark brown spot occurs on each exterior angle of the frontal margin. The falces are long, powerful, subconical, inclining to cuneiform, and vertical; the maxillæ are enlarged where the palpi are inserted, truncated at the extremity on the outer side, and inclined towards the lip, beyond which they extend considerably; the lip is long, somewhat triangular, and notched at the apex; the sternum is heart-shaped; the legs are long, slender, and provided with hairs and long spines; the first pair is the longest, then the second, and the third pair is the shortest; the tarsi are terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base; and the palpi, which are short, have a curved pectinated claw at their extremity. These parts are of a pale red-brown colour; the falces are the darkest, and the femur of each leg has two longitudinal brown lines on its inferior surface. The abdomen is long, slender, somewhat cylindrical, tapering to the spinners, and projects slightly over the base of the cephalothorax; it is densely clothed with short hairs, and the upper part, which is of a yellow-brown colour, bordered laterally by a red-brown line, is marked with numerous pale yellow streaks and spots symmetrically arranged, and disposed on similar streaks and spots either of a dark brown or of a red-brown hue; the colour of the under part is yellowish white; a large black band extends along the middle, whose anterior part comprises a short, longitudinal, yellowish-white streak; the sexual organs are highly developed, nearly circular, and of a dark reddish-brown colour, that of the branchial opercula being yellowish brown.

Family Epeïridæ.

Genus Gasteracantha, Latr.

Gasteracantha frontata.

Length of the female $\frac{1}{4}$th of an inch; length of the cephalothorax $\frac{1}{8}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{7}{16}$; length of a posterior leg $\frac{7}{24}$; length of a leg of the third pair $\frac{3}{16}$. The abdominal spines are not included in the measurement.

The cephalothorax is somewhat quadrate, the sides being slightly rounded; the anterior part is thinly clothed with short hairs, abruptly elevated throughout its entire breadth, and has on its summit two glossy protuberances which are separated by a longitudinal furrow; and the posterior part is depressed, with a large indentation in the medial line; it is of a dark brown colour faintly tinged with red, the middle of the posterior part having a yellow-brown hue. The eyes are small, and situated immediately above the frontal margin; the four intermediate

ones nearly form a square, the two anterior ones, which are seated on a slight protuberance, being larger and rather nearer to each other than the posterior ones; the eyes of each lateral pair are placed apart on a tubercle, and are distant from the intermediate ones. The falces are short, subconical, very powerful, convex in front, vertical, glossy, and armed with teeth on the inner surface; the maxillæ are short, straight, and greatly enlarged and rounded at the extremity; the lip is semicircular, but pointed at the apex; and the sternum is heart-shaped, with prominences on the sides, opposite to the legs, and terminates in a point. These parts are of a dark brown colour faintly tinged with red, the extremities of the maxillæ and lip and a large spot at the anterior part of the sternum having a yellow-red hue. The legs are short, moderately robust, provided with hairs, and of a dark brown hue tinged with dull red, particularly at the base of the joints; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by claws of the usual number and structure. The palpi, which are short, resemble the legs in colour, and have a curved pectinated claw at their extremity. The abdomen is more than twice as broad as it is long, and has a transversely narrow oval form, with somewhat sinuous margins, and six strong, conical, horizontal, rugged, hairy, dark brown spines, two of which are situated at its posterior margin and two at each extremity of the firm, glossy, transversely oval dorsal shield or carapace; the two anterior spines are the smallest, and the two intermediate ones the largest of the six; between the two anterior spines there are ten depressions, constituting conspicuous red-brown spots, the four intermediate ones, which are the smallest, and nearly equal in size, forming a straight, transverse row, somewhat in advance of the rest; four similar spots in the middle are disposed almost in a square, the two posterior ones being the largest and rather the widest apart; between the two intermediate spines there are nine red-brown depressed spots; five, smaller than the rest, form a straight transverse row somewhat in arrear of the others, the intermediate one being much the smallest; the colour of the carapace is brownish yellow, and there is a spot between the two posterior spines, and a smaller one at the base of each, of the same hue; the under part is very convex, corrugated, marked with numerous depressions, and of a dark brown colour spotted with reddish yellow; the spinners are encircled by a prominent rim, and are of a dark brown colour; a bold conical prominence of the same hue occurs immediately before them, and there is a small, obtuse, glossy, yellow protuberance near the base of each branchial operculum.

Gasteracantha helva.

Length of the female $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{3}{20}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{7}{24}$; length of a posterior leg $\frac{2}{5}$; length of a leg of the third pair $\frac{7}{24}$. The abdominal spines are not included in the measurement.

The abdomen is rather broader than long, and has somewhat the form of a trapezoid, the posterior side being the longest, and the anterior side much the shortest; it is provided with six strong, pointed, rugged, hairy, glossy, blue-black spines, each having a reddish-yellow streak on the under side extending from the base nearly half its length; two of the spines are situated at its posterior extremity, and two on each side of the carapace; the two anterior spines, which are the smallest and conical, are directed outwards and slightly upwards; the two intermediate ones, which are the largest, and nearly cylindrical, except at the point, are directed obliquely outwards and upwards; and the two posterior ones are conical and extended horizontally; the carapace is firm, glossy, and of a deep reddish-yellow colour; ten oval depressions, forming dark brown spots tinged with red, constitute a curved row near the lateral and frontal margins, the two lateral ones being the largest, and the two intermediate ones the smallest; four similar spots, but smaller and rounder, are situated in the middle, and almost describe a square, the two posterior ones being rather the widest apart; between the two largest spines there are ten depressions; the six intermediate ones form a slightly curved row whose convexity is directed forwards, and the two intermediate ones of the six are very minute and little conspicuous; the base of each posterior spine and the space between them have a deep reddish-yellow hue; the under part is very convex, greatly corrugated, marked with numerous depressions, and is of a dark brown colour spotted with deep reddish yellow; the spinners are encircled by a very prominent rim, and have a dark brown hue, and the sexual organs have a small, prominent, depressed, yellowish-brown process directed backwards from their posterior margin. The cephalothorax is somewhat quadrate, the sides being slightly rounded; the anterior part is abruptly elevated throughout its entire breadth, granulated, glossy, thinly clothed with whitish hairs, and has a longitudinal furrow in the middle; and the posterior part is depressed, with a large indentation in the medial line, and a smaller one on each side of it; it is of a brownish-black colour, the middle of the posterior part having a yellow-brown hue. The eyes are small, and situated immediately above the frontal margin; the four intermediate ones, which are seated on a protuberance, nearly form a square, the two anterior ones being larger and rather nearer to each other than the posterior

ones; the eyes of each lateral pair are placed apart on a tubercle, and are distant from the intermediate ones. The falces are short, very powerful, subconical, remarkably convex in front, protuberant near the base, towards the inner side, vertical, glossy, and armed with teeth on the inner surface; the maxillæ are short, straight, and greatly enlarged and rounded at the extremity; and the lip is semicircular, but pointed at the apex. These parts are of a brownish-black colour; the falces are the darkest, and the extremities of the maxillæ and lip have a yellow-brown hue. The sternum is heart-shaped, with prominences on the sides, opposite to the legs, and terminates in a point; it is granulated, supplied with long black hairs, and of a brownish-black colour, a transverse bar at its anterior part, two spots on each side, and one on the posterior point having a yellow hue. The legs are short, slender, provided with hairs, and of a reddish-yellow colour, with brown spots and streaks on the under surface of the femora, the upper surface of the genua and base of the tibiæ, and an annulus of the same hue at the base of the metatarsi and tarsi; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by claws of the usual number and structure. The palpi are short, of a brown-red hue, and have a curved pectinated claw at their extremity.

Genus NEPHILA, Leach.

Nephila ornata.

Length of the female $\frac{7}{16}$ths of an inch; length of the cephalothorax $\frac{1}{6}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{6}$; length of an anterior leg $\frac{5}{6}$; length of a leg of the third pair $\frac{1}{2}$.

The eyes are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones nearly form a square, the two anterior ones, which are on a protuberance, being smaller and rather nearer to each other than the posterior ones; the eyes of each lateral pair are placed obliquely on a prominent tubercle, and are near to each other, the anterior ones being much the smallest of the eight. The cephalothorax is compressed before, rounded on the sides, slightly convex, with an indentation in the medial line; it is of a brown colour, and is densely covered with short hairs having a silvery lustre. The falces are powerful, conical, vertical, armed with teeth on the inner surface, and have a dark brown hue. The maxillæ are straight, and are enlarged and rounded at the extremity, which has a brownish-yellow hue, that of the base being dark brown. The lip is semicircular, but pointed at the apex, and is of a pale yellow colour. The sternum is heart-shaped, with very conspicuous prominences on the sides, opposite to the legs, and termi-

nates in a point; it has a pale-yellow hue, with dark brown lateral margins. The legs, which are long, slender, and provided with hairs and a few spines, were so greatly mutilated, with the exception of those of the first and third pairs, that their relative length could not be satisfactorily determined; the tarsi are terminated by claws of the usual number and structure. The palpi are short, of a yellow hue tinged with brown, and have a curved pectinated claw at their extremity. The abdomen is of an oblong-oval form, moderately convex above, projecting a little over the base of the cephalothorax, and is somewhat prominent at its posterior extremity, above the spinners; the upper part, for more than a third of its length from the anterior extremity, is of a yellowish-white colour finely reticulated with brown, and is crossed by three transverse, slightly sinuous, dark brown bands, the intermediate one being rather the shortest and narrowest; these bands are succeeded by a broad, sinuous, dark brown band, of an orange-brown hue at its posterior margin, and comprising white spots of a silvery lustre, disposed transversely; a whitish band follows, having near its anterior margin a shorter, transverse, soot-coloured line; the posterior part, which has a dark brown hue, comprises white spots of a silvery lustre, and is crossed by two rather obscure, narrow, orange-brown bands, and a greatly curved, irregular, whitish one above the spinners; all the bands, with the exception of the second from the anterior extremity, are in contact with a fine, irregular, dark brown line extending along the upper part of each side; the sides have a yellow-brown hue, freckled with dull yellowish white, and spotted with dark brown in the posterior region; the under part is of a dark brown colour, with an irregular, longitudinal, whitish band, finely reticulated with brown, on each side; the space included between these bands, which is broadest and darkest at its posterior extremity, comprises in its anterior part six whitish spots disposed in pairs; the spinners have a reddish-yellow hue.

Though the specimen from which the foregoing description was made had not arrived at maturity, yet there can be little doubt of its specific distinctness.

Genus Tetragnatha, Latr.

Tetragnatha decorata.

Length of the female $\frac{7}{20}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{8}$.

The abdomen is robust, subcylindrical, with an obtuse protuberance on each side of its anterior extremity, which projects greatly over the base of the cephalothorax, and terminates in a

large, obtuse, conical protuberance, slightly curved upwards, that extends considerably beyond the spinners; it has a bright silvery lustre; a black band extends along the middle of the upper part to the posterior conical protuberance, and is crossed at its anterior extremity by a broad strongly curved black band, within whose curvature there is a short transverse line of the same hue; on each side of the medial band a shorter, nearly parallel black band occurs; these bands, which commence near the extremities of the curved band, are connected anteriorly by a transverse black bar, laterally by four oblique lines of the same hue, diverging in pairs from the medial band, and posteriorly by converging till they meet; irregular longitudinal bands and short oblique streaks on the sides, and a space round the spinners, have a black hue, the last comprising four silvery spots disposed symmetrically about the spinners; the sexual organs are moderately developed, and of a dark reddish-brown colour, that of the branchial opercula being yellowish brown. The cephalothorax is small, slightly convex, glossy, compressed before, rounded in front and on the sides, with a large indentation in the medial line; the falces are short, powerful, very convex in front, rather divergent at the extremity, and armed with a dark, red-brown fang, and a few teeth on the inner surface; the maxillæ are divergent, and increase in breadth from the base to the extremity, which is somewhat angular on the outer side; the sternum is heart-shaped, with small prominences on the sides, opposite to the legs; the legs are long, slender, and provided with hairs and spines: those of the specimens from which the description was made were mutilated; but, from the relative length of the femora, it is evident that the first pair is the longest, then the second, and that the third pair is much the shortest; the palpi are short and slender. These parts have a yellow-brown colour. The lip is semicircular and prominent at the apex, which has a yellow-brown hue, that of the base being dark brown. The eyes are nearly equal in size, and are seated on black spots on the anterior part of the cephalothorax; the four intermediate ones form a square, and those of each lateral pair (which are placed on a minute tubercle near to each other, but not in contact) are rather the smallest of the eight.

V.—*Diagnoses of new Forms of Mollusks collected at Cape St. Lucas by* Mr. J. Xantus. By Philip P. Carpenter, B.A., Ph.D.

[Concluded from vol. xiii. p. 479.]

37. *Mangelia subdiaphana.*

M. testa parva, subdiaphana, albida, interdum rufo-fusco pallide

tincta; satis turrita, marginibus spiræ parum excurvatis; anfr. nucleosis iii., lævibus, diaphanis, apice mamillato; norm. iv., satis excurvatis, haud angulatis, suturis impressis; fascia super spiram pallide fusca, alteraque candida contigua; costulis radiantibus xiv.–xviii., acutis, subrectis, distantibus, interstitiis undatis; tota superficie minute et creberrime spiraliter striata; basi producta, striis magis expressis; apertura subelongata; labro ad dorsum incrassato, postice distincte emarginato, intus haud dentato; labio tenuissimo; columella recta, antice late canaliculata. Long. ·19, long. spir. ·1, lat. ·06 poll., div. 30°.

38. *Drillia appressa.*

D. testa parva, compacta; rufo-fusca, interdum supra costas pallidiore; marginibus spiræ excurvatis; anfr. norm. vi., planatis, suturis indistinctis; costis tuberculosis radiantibus circ. xiv., antice et postice obsoletis; striolis spiralibus creberrimis; costa spirali irregulari postica, tuberculosa, super suturas appressa; area sinus parvi vix definita; basi satis prolongata; apertura subquadrata; labio distincto. Long. ·3, long. spir. ·17, lat. ·12 poll., div. 40°.

39. *Cithara fusconotata.*

C. testa parva, satis turrita, tenui, albida; postice linea, seu serie macularum, rufo-fusca, interdum altera peripheriali ornata; marginibus spiræ rectioribus; anfr. nucl. ii., rotundatis, apice mamillato; norm. vi., in spira rotundatis, suturis impressis; basi satis rotundata; costis radiantibus circ. ix., acutis, distantibus, antice et postice subobsoletis; tota superficie spiraliter sulcata, sulculis subdistantibus, undatis, costas superantibus; apertura subovali, satis elongata, postice valde sinuata; labro acuto, dorsaliter costulato, intus haud dentato; labio tenui. Long. ·36, long. spir. ·18, lat. ·16 poll., div. 40°.

40. *Obeliscus variegatus.*

O. testa *O. hastato* simili; nitidissima, striolis incrementi exilissimis; livido et castaneo varie nebulosa; prope suturam canaliculatam lineis albidis picta; hic et illic callositate alba interna; peripheria circa basin insculpta, unicolore; columella truncata, triplicata; plica superiore acuta, exstante, circa basim continua; plicis anticis parvis, spiralibus. Long. ·44, long. spir. ·3, lat. ·15 poll., div. 23°.

41. *Odostomia* (*Evalea*) *æquisculpta.*

O. testa parva, ovoidea, alba, subdiaphana; marginibus spiræ subrectis; vert. nucl. ?. . . ., normaliter truncato; anfr. norm. iv., parum arcuatis, suturis impressis; tota superficie costulis spiralibus circ. xiv., quarum vi. in spira monstrantur, latis, planatis, æquidistantibus; interstitiis parvis; basi rotundata; apertura ovata; peritremate haud continuo; labro acuto; labio subobsoleto; plica juxta parietem conspicua, acuta, transversa; columella arcuata,

rimulam umbilicalem formante. Long. ·07, long. spir. ·04, lat. ·03 poll., div. 40°.

42. *Odostomia (Evalea) delicatula.*

O. testa tenuissima, alba, diaphana, nitente, elongata; marginibus spiræ eleganter excurvatis; vert. nucl. lævi, globoso, decliviter immerso; anfr. norm. iii., subplanatis, suturis impressis; liris subacutis, spiralibus, quarum v. in spira monstrantur; interstitiis latis, undatis, creberrime decussatis; basi elongata; apertura oblonga, peritremate haud continuo; labro tenui; labio vix conspicuo; plica juxta parietem exstante, declivi. Long. ·075, long. spir. ·04, lat. ·03 poll., div. 30°.

43. *Chrysallida angusta.*

C. testa parva, satis elongata, nitida, alba, sculptura minus expressa; marginibus spiræ parum excurvatis; vert. nucl. parvo, subito immerso, dimidium truncationis tegente; anfr. norm. v., planatis, elongatis, suturis minus impressis; costis radiantibus circ. xiii., plerumque lineis continuis marginibus utrinque parallelis, circa basim productam obsoletis; lirulis spiralibus angustis, in spira circ. v., interstitiis decussantibus, supra costas haud nodulosis; apertura ovali; peritremate parum continuo; labro tenui, translucido; labio tenui; plica juxta parietem parva, obtusa. Long. ·095, long. spir. ·065, lat. ·028 poll., div. 20°.

44. *Eulima fuscostrigata.*

E. testa minore, gracillima, albida, striga latiore rufo-fusca supra peripheriam ornata; basi quoque rufo-fusca, valde prolongata, regulariter excurvata; anfr. nucl. ii., tumidioribus; norm. viii., planatis, suturis haud conspicuis; varicibus nullis; apertura valde elongata; labro vix sinuato; labio vix calloso. Long. ·17, long. spir. ·12, lat. ·05 poll., div. 20°.

45. *Opalia crenatoides.*

O. testa turrita, alba, marginibus spiræ rectis; anfr. nucl.?....; norm. vi., compactis, attingentibus; costis radiantibus circ. x., in spira plerumque obsoletis, ultimo anfractu validioribus, latis, haud exstantibus, attingentibus, spiram lineis fere rectis ascendentibus; suturis inter costas altissime indentatis; carina obtusa basali, suturæ continua; inter costas radiantes undique, ut in suturis, indentata; costis interdum, propter lirulas spirales subobsoletas, subnodosis; columella haud umbilicata; basi antice lævi. Long. ·54, long. spir. ·38, lat. ·23 poll., div. 30°.

Additional specimens may connect this with the Portuguese *O. crenata.*

46. *Truncaria eurytoides.*

T. testa parva, turrita, gracili; albida, sæpius fascia circa peripheriam maculis fusco-aurantiacis picta; anfr. nucl. mamillatis, lævibus;

norm. v., effusis, subplanatis, ultimo paulum constricto; costulis radiantibus circ. xx., aperturam versus evanidis; apertura subquadrata; labro haud incrassato, interdum intus subtiliter striato, haud dentato; labio appresso; columella abrupte truncata. Long. ·3, long. spir. ·2, lat. ·11 poll., div. 23°.

Variat basi fusco tincta, seu tota superficie ut in *Nitidella cribraria* picta.

47. *Sistrum* (? *ochrostoma,* var.) *rufonotatum.*

S. testa *S. ochrostomati* simili, sed minore, angustiore, vix tabulata; alba, linea punctorum rufo-fuscorum subperipheriali, interdum lineis spiralibus, interdum ejusdem coloris maculis, ornata; vert. nucl. mamillato, anfr. iii., lævibus, vix tumidis; norm. v., plus minusve elongatis, in medio nodoso-angulatis, postice planatis, suturis ad angulum valde obtusum conspicuis; seriebus nodulorum spiralibus iii., quarum postica major, secundum costas radiantes obsoletas circ. vi.–viii. ordinatis; seriebus anticis inconspicuis ii.; interdum costulis spiralibus intercalatis; canali brevi, rectiore, aperto, angusto; apertura subovali, vix subquadrata, intus pallide aurantiaca; labro acutiore, dorsaliter subvaricoso, postice sæpe sinuato, intus obscure vi.-dentato; labio conspicuo, interdum exstante. Long. ·5, long. spir. ·23, lat. ·32 poll., div. 60°.

Variat testa obesa, nodulis validis. Variat quoque testa acuminata, nodulis subobsoletis. Long. ·52, long. spir. ·23, lat. ·25 poll., div. 42°.

48. ?*Nitidella millepunctata.*

?*N.* testa parva, nitida, livida; spira exstante, anfractibus subplanatis, suturis distinctis; anfr. nucl. lævibus, adolescentibus obsolete radiatim lirulatis, adultis lævibus; zona alba postica, suturam attingente, aurantiaco maculata; tota præter zonam superficie aurantiaco puncticulata, punctis minimis, creberrimis, in quincunces dispositis; apertura subquadrata; labro incrassato, intus vi.-dentato; labio exstante, a lirulis circa basim spiralibus indentato. Long. ·3, long. spir. ·17, lat. ·15 poll., div. 40°.

Differs from *Columbella albuginosa,* Rve., in its peculiar and constant painting.

49. ?*Nitidella densilineata.*

?*N.* testa ?*N. millepunctatam* forma et indole simulante, sed omnino nitida, anfractibus planatis, suturis indistinctis, striolis circa basim minimis; livida, lineolis aurantiaco-fuscis divaricatis, sæpe ziczacformibus, densissime signata. Long. ·25, long. spir. ·15, lat. ·1 poll., div. 35°.

The opercula of these two species being unknown, their generic position remains doubtful. The same is true of the two following.

50. ?*Anachis tincta.*

?*A.* testa parva, turrita, albida, rufo-aurantiaco supra costas tincta; anfr. nucl. lævibus; norm. iv.–v., subplanatis, suturis valde im-

pressis; costulis x. radiantibus, et liris spiralibus transeuntibus, in spira iii. supra costas conspicuis, unaque in sutura, dense insculpta; interstitiis alte cælatis; apertura subquadrata; labro in medio incrassato. Long. ·19, long. spir. ·12, lat. ·08 poll., div. 30°.

51. ?*Anachis fuscostrigata.*

?*A.* testa parva, turrita, livida, nitida; zonis rufo-fuscis, subspiralibus, in spira circ. iii., interdum, maxime ad basim, confluentibus, conspicue cincta; lirulis radiantibus subobsoletis, circ. x., prope suturam se monstrantibus; apertura subquadrata. Long. ·13, long. spir. ·095, lat. ·045 poll., div. 20°.

52. *Pisania elata.*

P. testa minore, valde turrita, Latiroidea; alba, rufo-fusco antice et postice varie maculata seu strigata; anfr. nucl. ?. . . . ; norm. vi., convexis, suturis impressis; costis radiantibus vi.–viii., obtusis, interstitiis undatis; lirulis spiralibus distantibus, in spira plerumque iii., aliis minoribus intercalantibus; canali angusto, subrecurvato; apertura subovata; pariete postice dentata; columella parum contorta. Long. ·68, long. spir. ·37, lat. ·29 poll., div. 38°.

VI.—*On the* Menispermaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from vol. xiii. p. 491.]

9. Anamirta.

This genus was proposed in 1819 by Colebrook for the typical species, of which he had only seen the male plant: the male and female plants were afterwards described, with more precision, and figured by Dr. Arnott: but there are some few inaccuracies in those details; for the anthers in the male flower are aggregated upon a scarcely elevated receptacle, not raised upon a stipitated column, as is there shown, and in the female flower the monadelphous ring of 10 sterile stamens is altogether overlooked, as is likewise the 5-lobed raised gynæcium. *Anamirta* resembles *Parabæna* in the aggregation of its numerous stamens upon a receptacle, their number varying in different species from 15 to 55. It is stated by Dr. Arnott, as well as by the authors of the 'Flora Indica,' that the female flower bears 3 ovaries; I have found constantly 4 or 5, and have never met with a smaller number in the many flowers I have examined. The normal number would seem to be 5, judging from the proportion of the sterile stamens that surround them, these being invariably 10, in a single series, united in an annular ring (not 9, as stated by those authorities). The number of sepals is in-

constant in the same panicle of flowers, varying from 7 to 12, including 3 minute basal bracts, which also vary in number and size; they are much imbricated. There are no petals. The drupes are fleshy and gibbously oval, the persistent stigma being very excentric, and much nearer the base than the apex: here the gynæcium by subsequent growth is converted into a stout cylindrical carpophorum *, which becomes divided at its summit into 2, 3, or 4 forks, answering to the number of drupes perfected, leaving cicatrices corresponding with the number of abortive ovaries—a development similar to that I have described in *Tiliacora* and *Sciadotenia*. The putamen is oval, with a short reniform sinus on its ventral face; it is of a thin corneous texture, its smooth surface is grooved in a net-like form, the grooves being filled with capillary fibres, from which it may be inferred that in a fresh state its mesocarp consists of aggregated masses like those observed in *Anomospermum*; on the side of the reniform depression of the putamen, there are two small circular apertures leading into two distinct chambers of the large subglobular condyle, which projects far into the centre of the cell, and the integuments of the seed enter into the deep groove along its face, and are there firmly attached along the line of the raphe. The structure of its seed quite corresponds with the rest of the *Heterocliniecæ*, but the fissures of the ruminated albumen do not penetrate so deeply as in many genera: the cotyledons are extremely divaricated, and enclosed in distinct cells of the albumen.

The authors of the 'Flora Indica' acknowledge only the original type, but *A. lemniscata* from Java, as well as others to be described in the 'Contributions to Botany,' are distinct species; they do not admit *A. flavescens*, which appears to me correctly referred here by Wight and Arnott, and they regard the Ceylon species, *A. toxifera*, as being identical with the type; but the grounds on which they are considered distinct will be stated. Concerning *A. Bauerana* of Endlicher, I can learn nothing: it is figured in his 'Atakta'—a book I have not been able to consult, nor can I find in any botanical work a description of the species.

Anamirta, Coleb.—*Flores* dioici. *Masc. Sepala* 7–12, imbricata, quorum 2–4 exteriora minora, ovata, concava, submembranacea. *Petala* nulla. *Stamina* 15–55, receptaculo parvo sessili, pluriseriatim in globum aggregata: *filamenta* fere obsoleta: *antheræ* 4-lobæ, sub-4-locellatæ, rima transversa 2-val-

* It would be well to confine the use of the term *Carpophorum* to those kinds of development resulting from the growth of the torus, leaving the word *Carpodium* to designate the stipitate support where it is an increment of the fruit itself.

vatim hiantes.—*Fœm.* *Sepala* ut in masc. *Petala* nulla. *Stamina* sterilia 10, brevissima, carnosula, compressa, apice emarginata, effœta, imo in annulum brevem circa gynæcium coalita. *Ovaria* sæpius 4 vel 5 supra gynæcium breviter cylindricum imposita, erecta, gibba, glabra, 1-locularia, *ovulo* unico in angulo ventrali appenso. *Stylus* brevissimus, crassiusculus. *Stigma* validum, subito reflexum, deltoideum, convexum, papillosum. *Drupæ* 1–5, ovatæ, subcarnosæ, stigmate valde excentrico notatæ, carpophoro longiusculo lignoso incrassato cylindrico apice furcato suffultæ, furcis tot quot drupis, iisdem articulatis: *putamen* ovatum, ad ventrem reniformi-excavatum, tenuiter osseum, 1-loculare, sutura peripherica, sub-2-valvare, indehiscens; *condylus* omnino internus, majusculus, globosus, 2-cameratus, ultra medium loculi protensus, foraminibus 2 collateraliter sejunctis externe apertis instructus. *Semen* loculo conforme, meniscoideum, facie ventrali valde cavum, et hinc ad condylum affixum: *integumenta* tenuissima, per *raphem* linearem ventralem sulco condyli intrusa: *embryo* paulo convexus, intra *albumen* copiosum fere 2-laminare ventre ruminatum inclusus: *cotyledones* tenuiter foliaceæ, lineari-oblongæ, lateraliter valde divaricatæ, in locellis sejunctis sepultæ, *radicula* brevi tereti supera axin versus inclinata et ad stylum spectante multoties longiores.

Frutices *scandentes Indiæ orientalis et Insularum incolæ, sæpius glabri,* cortice *suberoso*; folia *majuscula, late ovata, sæpe cordata, integerrima, subcoriacea, longe petiolata*; paniculæ *racemosæ, supra-axillares, elongatæ, pendulæ*; flores *pedicellati,* pedicellis *basi et medio 3-bracteatis.*

1. *Anamirta paniculata,* Coleb.;—India Orient.
2. —— *flavescens,* nob.;—Molucca.
3. —— *toxifera,* nob.;—Ceylon.
4. —— *populifolia,* nob.;—Timor.
5. —— *lemniscata,* nob.;—Java.
6. —— *luctuosa,* nob.;—Java.
7. —— *jucunda,* nob.;—Java.

The details of these species will be given in the 'Contributions to Botany,' vol. iii.

10. Parabæna.

This genus was proposed by me in 1851 for the *Cocculus sagittatus* and *C. oleraceus,* Wall. These were considered by Dr. Wallich as distinct species. They are climbing plants, natives of India and Ava, with oblong, extremely cordate or sagittate leaves, either entire or deeply and sinuously dentated. The genus agrees with *Anamirta* in having its anthers aggregated in

a globular head, not sessile as in that genus, but borne on the apex of a long slender monadelphous column as in *Cissampelos.* It has 6 sepals, obsoletely saccate or swollen at base, as in *Jateorhiza,* imbricated in 2 series, and 6 distinct petals. The sterile stamens of the female flower are arranged in an annular whorl round the stipitate gynæcium, on which 3 unilocular ovaries are seated. The putamen, as in *Rhigiocarya,* is covered with prominent, obtusely hooked, echinated spines, arranged in longitudinal series, the dorsal middle row terminating in a long apical tooth. The condyle is formed as in *Odontocarya* and *Aspidocarya;* but, for want of perfect specimens, the shape of the embryo is not known.

PARABÆNA, nob.—*Flores* dioici. *Masc. Sepala* 6, oblonga vel spathulato-oblonga, 2-seriata, imo carnosa et subsaccata, 3 exteriora angustiora et paulo breviora, extus sericea, æstivatione imbricata. *Petala* 6, parva, spathulato-oblonga, extus dorso carinata, imo carnosa, erecta. *Stamina* monadelpha: *filamenta* in columnam teretem gracilem centralem coalita; *antheræ* 6, subglobosæ, supra columnam 2-serialiter arcte aggregatæ, 4-sulcatæ, 4-locellatæ, rima transversali 2-valvatim hiantes.—*Fœm. Sepala* et *petala* ut in masc. *Stamina* sterilia 6, gynæcium ambientia, summo glanduloso-4-loba. *Ovaria* 3, gynæcio brevi imposita, libera, erecta, gibba, glabra, 1-locularia, *ovulo* unico ad angulum internum medio appenso; *stylus* brevis, teres; *stigma* dilatato-recurvum, sulcatum. *Drupæ* 3, ovatæ, subcarnosæ, stigmate persistente subexcentrico apiculatæ: *putamen* osseum, suborbiculare, compressum, ventre subplanum, ad dorsum convexum, spinis obtusis hamatis in seriebus longitudinalibus exasperatum, serie centrali prominentiore, et hinc in dentem longum apiculatum: *condylus* medio faciei ventralis, ovatus, extus concavus, intra loculum convexus; *semen* loculo conforme, summo condyli affixum; cætera ignota.

Frutices *scandentes Indiæ orientalis;* folia *oblonga aut ovata, apice repente attenuata, cordata, vel angulato-hastata,* 5–9-*nervia, integra, aut sinuato-dentata;* panicula *axillaris, petiolo sublongior.*

1. *Parabæna sagittata,* nob.;—Ind. Orient.

Described in the 'Contributions to Botany,' vol. iii.

11. ASPIDOCARYA.

This genus, established by the authors of the 'Flora Indica,' is one of much interest; its stamens are monadelphous after the manner of *Cissampelos;* the shape of its extremely flattened puta-

men, with pectinated margins, is a modification of that of *Calycocarpum*, and its condyle is nearly evanescent as in *Tinomiscium*: the form of its embryo with divaricated cotyledons, imbedded in distinct cells of the albumen, places the genus among the *Heteroclinieæ*.

ASPIDOCARYA, H. & Th.—*Flores* dioici. *Masc. Sepala* 12, in seriebus ternatim imbricata, 6 interiora obovata, concava, submembranacea, glabra, 3-nervia, 6 exteriora gradatim minora et angustiora, margine ciliata. *Petala* 6, æqualia, sepalis dimidio breviora, rotundata, breviter unguiculata, marginibus infra medium auriculatim inflexis, nervis 3 ad medium protensis et illinc arcuatim nexis. *Stamen* unicum centrale; *filamentum* tenuiter columnare, sepalis æquilongum; *antheræ* 6, bilobæ, ad oram connectivi peltato-disciformis connatæ, margine rima transversa dehiscentes.—*Fl. fœm. Sepala* et *petala* ut in masc. *Stamina* sterilia 6, clavata. *Ovaria* 3; *stigma* subcapitatum, sec. cl. auct. *Drupæ* 3, oblongo-ovatæ, pulposæ: *putamen* subosseum, subovatum, lenticulari-compressum, utrinque paulo convexum, facie dorsali carina elevata apice basique excurrente cristatum, utroque margine in aciem sinuato-pectinatam vel truncato-dentatam late expansum, 1-loculare; *condylus* obsoletus, nisi in striam longitudinalem discessus; *semen* loculo conforme, ovatum, valde compressum: *integumenta* tenuiter membranacea, facie ventrali linea obscura longitudinali et raphe notata, et hinc ad striam condyli adherentia: *embryo* intra *albumen* carnosum fere 2-laminare simplex inclusus; *cotyledonibus* foliaceis, oblongis, acutis, valde divaricatis, in locellis sejunctis utrinque positis, *radicula* supera tereti multo longioribus.

Frutex *scandens Indiæ orientalis*; folia *ovato-oblonga, subcordata, acuta, et subito attenuata, submembranacea,* 5-*nervia, subglabra, in nervis pubescentia, longe et tenuiter petiolata*; panicula *racemosa, supra-axillaris, folio subæqualis*; flores *parvi, viridescentes.*

1. *Aspidocarya uvifera*, H. & Th.;—Sikhim.

Particulars of this species will be given in the 'Contributions to Botany,' vol. iii.

[To be continued.]

VII.—*Observations on Raphides.* By GEORGE GULLIVER, F.R.S.

[Continued from vol. xiii. p. 511.]

Practical Applications.—At present, these will be confined to Dicotyledones, and, like all my former observations, entirely to

the British Flora, unless when expressly extended beyond it. Of every order in Prof. Babington's 'Manual' I have examined at least one species, often more, and sometimes the whole or nearly the whole; and whenever raphides were found in any order, all or the greater part of its species were manytimes diligently searched, as well as those of the orders between which the raphis-bearing one might happen to stand. But as it was frequently difficult for me to procure more than one specimen of a plant, and still less easy to get every species of an order, and to be sure of avoiding errors, these practical applications will be now described provisionally, and yet not without a belief that their utility and naturalness are likely to remain after a much more complete series of valid tests than I have been able to apply. The subject, even as limited in this paper, is so extensive as to require for its full elucidation the cooperation of many labourers in different parts of the kingdom; and any botanist who may choose to try the reality of the raphidian character of such an order as Onagraceæ may quickly and easily do so in some of the most common plants throughout our country.

In the last communication, additional evidence was given of the validity and practicability of this character in Galiaceæ, and that it is at least as remarkable in Balsaminaceæ and Onagraceæ. Now these three are the only orders of our Dicotyledones that can yet be truly characterized as raphis-bearers,—a fact which I have already found very useful in cases where no other botanical diagnosis was available. And hence, until this raphidian character be proved either defective or more extensive, whenever a British plant of that class be found abounding in raphides, it must be referred to one or other of those three orders.

But this conclusion will appear so paradoxical, rejecting the raphis-bearing character of many trees and shrubs which are commonly cited by authors as special examples of it, opposed also to the current views on the subject generally in our best works on phytotomy and to the neglect of it particularly in those of systematic botany, that a few explanatory remarks may here be repeated.

When Schleiden states that "the needle-formed crystals, in bundles of from twenty to thirty in a single cell, are present in almost all plants," we can only certainly say that they must be very difficult to detect, if ever present at all, in many entire orders of British plants, and that, though the conclusion of such an eminent observer is not to be lightly treated, it cannot yet be reconciled with the facts so often disclosed in the course of the present communications.

Other statements, apparently coinciding with that of Schleiden, when carefully examined both by their context and by the light

of nature, are more easily explicable. Thus when, under the article "Raphides" in the last edition of the valuable 'Micrographic Dictionary,' we are told that there are few of the higher plants which do not contain them, and that they abound in Euphorbiaceæ, Cactaceæ, and Polygonaceæ, and in the roots of Umbelliferæ and the sepals of Geraniaceæ and Orchidaceæ, it is certain that sphæraphides and other crystals are confounded with raphides, and that these last are by no means limited to the calyx in Orchidaceæ. Of Euphorbiaceæ my examinations have been confined to our indigenous species, in which I have not yet seen bundles of raphides, and suppose that the starch-sticks in the latex of this order ('Annals,' March 1862) may have been originally described by Rafn as saline crystals, and the error often copied since; but with his observations I am only acquainted at second hand. And while sphæraphides and other crystals are so common in our trees and shrubs, I have never found these plants characterized by raphides; so that this department alone still affords an interesting field of research*. Again, the minute single crystals which I have described in the ovaries of British Compositæ and in the leaves of *Gentiana acaulis* are not true raphides. As to systematic botany, the value of raphides as natural characters seems never to have been at all recognized,—certainly not in our best English works. Nor indeed was it likely to be while the statements of Schleiden and others, already alluded to, remained current; and the paucity, confusion, and uncertainty of the facts made them utterly insufficient and unavailable for the purpose. And this is the more remarkable after such an illustrious botanist as Lindley (Intr. to Bot. 3rd ed.), with the excellent assistance of Edwin Quekett, had long since perceived the interest of raphides in connexion with organography, and pointed out their presence in certain Nyctaginaceæ, Orchidaceæ, and Araceæ.

Of the practical applications a few more instructive examples may be added. In gardening operations, I have always found it easy, and often very useful, to pick out, simply by the raphidian character, seedlings of the many exotic Onagraceæ, now so commonly cultivated, from seedlings of other orders. And some

* If our Societies would offer prizes to young persons for inquiries of this kind, instead of temptations to the extirpation of our rare native plants, some good might result; for numerous observations with a definite aim, and such as may be easily made with a cheap microscope, are much required; and they are calculated to elevate the taste to a perception of the importance of the life of the plant-cell, and to open a wide field of rational amusement and instruction for families in the country. As to species, those of such genera as *Carex* and *Salix*, *Rosa* and *Rubus*, would be well fitted to try the knowledge and industry of students.

Mesembryeæ, which had been sown in pots and got confused with other pots containing seedlings of exotic Crassulaceæ, were all as easily and quickly distinguished by the same character. The raphides in all these instances, though smaller than in adult plants of the same species, were very plainly seen collected into bundles in the seed-leaves and infant stems and plumules. And the practical application of the raphidian diagnosis may be equally simple and sure in old plants at every period of their existence; for, besides the evidence formerly given, it was found particularly serviceable in the absence of any other botanical character. Thus in a reserve bed containing several species or varieties of *Œnothera*, and many Phloxes, Campions, Rockets, and other plants, intended for removal when required, all the Onagraceæ were readily identified by the abundance of raphides in their roots and subterranean leaf-buds, before growth had revived, in the early spring. But there was a tough creeping root with stem-buds, certainly not an *Œnothera*, and yet abounding in raphides. What could this be? As we were here puzzled, it was put into a pot for further observations, and soon became a good specimen of *Asperula odorata*, a plant of the raphis-bearing order Galiaceæ.

Finally, as to the opinion of Link and E. Quekett that raphides in plants are, like calculi in animals, "nothing more than accidental deposits," the sum of my experience, on the contrary, is that they are really such an intrinsic effect of the plant-life, from the cradle to the grave, of the species in which they abound, as to be quite as fundamentally and universally present therein as any other speciality or single diagnostic whatever, and moreover surely expository of an essential part of the very nature of those species. And, although, on a subject so novel and extensive, the results obtained by a single observer can only be offered provisionally, it appears to me that the present practical applications are sufficient to prove the importance of raphides as natural characters; that their precise value in this point of view requires further and very extended researches, more especially as regards the flora of the world; and that, so far as concerns the class Dicotyledones of the British Flora, the orders Balsaminaceæ, Onagraceæ, and Galiaceæ are eminently entitled to be characterized as raphis-bearing plants.

Edenbridge, May 30, 1864.

[To be continued.]

VIII.—*Notes on the Hydroida.* By Prof. Allman, F.R.S.

I.

Note, supplemental and corrective, to a Synopsis of the Genera and Species of Tubularian and Campanularian Hydroids, published in the 'Annals and Magazine of Natural History' for May 1864, p. 350.

[Plate II.]

Perigonimus vestitus, Allman, n. sp.*

Trophosome.—Hydrocaulus composed of numerous stems, from half a line to two lines in height, becoming greatly dilated towards the summit, simple or occasionally with one or two short lateral branches, and connected by a delicate creeping and retiform hydrorhiza; periderm yellowish brown, with adherent particles of sand. Polypites with from six to ten tentacles, which are roughened by irregularly annular groups of minute thread-cells, and in extension are usually held with the alternate ones elevated and depressed; a delicate continuation of the periderm extends over the whole of the body of the polypite beyond the tentacles, and almost to the margin of the mouth; this peridermic covering, however, is not continued over the tentacles, but becomes lost on their roots.

Gonosome.—Gonophores elevated on long peduncles, which spring from the hydrocaulus and occasionally also from the hydrorhiza, the peduncle for about its proximal half being invested by a continuation of the opake chitinous periderm. Medusa, at the time of liberation, oviform, the cavity of the umbrella being very deep, and the umbrella-mouth ("codonostome") much contracted; umbrella-walls very thin and with minute scattered thread-cells immersed in them; two opposite marginal tentacles with non-ocellated bulbous bases, the intervening radiating canals terminating each in a smaller bulb, from which no tentacle has been developed; manubrium with four shallow lips.

Perigonimus vestitus was met with in the Firth of Forth in June, growing upon an old *Buccinum*-shell, where it was associated with *Hydractinia echinata.* In the continuation of the periderm over the body of the polypite, as well as in general habit, it comes very near to the *Perigonimus* (*Atractylis*) *palliatus* of Wright, from which, however, it differs, judging from Dr. Wright's description and figures, in its more developed hydrocaulus, in the position of the gonophores—which are here borne

* With the exception of *Perigonimus vestitus* and *Tubularia humilis,* which are now recorded for the first time, all the species here described will be found under their respective genera in the Synopsis, where, however, they are simply enumerated, without any description.

almost exclusively on the hydrocaulus, only an occasional one being here and there developed from the hydrorhiza, while in *P. palliatus* they are confined to the hydrorhiza,—and in the form of the medusa, whose contracted codonostome gives to the umbrella, at the time of liberation, an oviform shape which is very striking and peculiar, while in *P. palliatus* the umbrella does not become contracted towards the codonostome, and is accordingly nearly cylindrical in form *.

In medusæ now about the tenth day since their liberation, and still alive in my tanks, the form has undergone considerable change, the umbrella having become nearly spherical, thus presenting a further departure from the medusa described by Dr. Wright as proceeding from *P. palliatus*. No increase, however, has taken place in the number of marginal tentacles.

Bougainvillia fruticosa, Allman, n. s.

Trophosome.—Hydrocaulus rising to the height of about two inches, much branched, with the main stems composed of aggregated tubes, branches subalternate, periderm of the smaller branches marked by shallow transverse corrugations, which become obsolete on the larger branches and main stems: polypites in extreme extension nearly cylindrical, with the periderm continued for a short distance over the posterior part of their body as a thin pellicle, which in extreme contraction appears as a membranous corrugated cup, into which the polypite has become withdrawn for about its posterior third.

Gonosome.—Gonophores pyriform on distinct peduncles springing from the upper side of the ultimate ramuli, along which they extend nearly from the origin to the termination of the ramulus.

I met with *B. fruticosa* in September, growing in abundance on a large piece of floating timber in the mouth of the Kenmare River, coast of Kerry.

Bougainvillia fruticosa, though closely allied to *B. ramosa*, Van Ben., differs from it in the more cylindrical and slender form of the extended polypite, in the less extent to which the polypite is invested by the membranous dilatation of the chitinous periderm, and in the disposition of the gonophores. While in *B. fruticosa* the polypites in extreme retraction have the tentacles and nearly two-thirds of the body exposed, the contracted polypites of *B. ramosa* are almost entirely concealed within the dilated periderm. In *B. ramosa*, moreover, the gonophores, instead of being borne along the whole of the upper surface of the ultimate ramuli, are confined to their distal extremity, where they occur singly or in a pair consisting of two opposite gonophores, or else in an

* See Dr. Wright's description of *Atractylis pallida*, in Ann. Nat. Hist. for Aug. 1861, p. 129, pl. 4. figs. 6 & 7.

imperfect verticil of three or more. Between the medusa of the various species of *Bougainvillia* whose trophosome has been observed I cannot discover any difference which could be advantageously employed in the diagnosis.

Heterocordyle, Allman *.

Gen. char.: *Trophosome.*—Cœnosarc consisting of a simple or branched hydrocaulus, which arises from a creeping filiform and anastomosing hydrorhiza, the whole invested by a chitinous periderm. Polypites fusiform, with a single verticil of filiform tentacula round the base of a conical metastome.

Gonosome.—Gonophores adelocodonic, borne by gonoblastidia which are developed (solely ?) from the hydrorhiza; sporosacs in the form of simple fixed sacs destitute of tentacles and cilia.

Species unica: *H. Conybearei*, Allman. Plate II.

Trophosome.—Hydrocaulus consisting of numerous much-branched stems, along with short simple ones, all crowded on the creeping hydrorhiza, the longest stems attaining a height of about four lines; periderm transversely corrugated, slightly dilated at the base of the polypites, ash-brown. Polypites with about twelve tentacula, usually held straight on extension, with the alternate ones depressed when partially contracted, the tentacles present a slightly clavate outline at their extremities.

Gonosome.—Gonoblastidium springing out of a short tubular process from the upper surface of the hydrorhiza, club-shaped, its distal extremity thickly set with thread-cells; gonophores numerous, on very short peduncles, densely crowded, commencing a little behind the distal extremity of the gonoblastidium, and thence extending to within a short distance of its base.

H. Conybearei was obtained last autumn in considerable abundance in the Harbour of Glengariff, co. Cork, investing old univalve shells which had been taken possession of by hermit crabs. In habit it exactly resembles *Dicoryne conferta*, and without the aid of a microscope might be easily mistaken for this species; but the structure of the gonophores, which are simple sporosacs, entirely resembling those of *Clava*, must remove it by a wide interval from *Dicoryne*.

I have much pleasure in calling the present species after an ardent and scientific worker with the microscope, a member of a family whose name is already inseparably united with the progress of natural science in these islands, Henry Conybeare, Esq., in whose company, during a dredging-expedition in the

* I have already given in the Synopsis a diagnosis of this genus, unaccompanied, however, by a figure or by a description of the only known species.

beautiful Harbour of Glengariff, this very distinct hydroid was obtained.

Tubularia humilis, Allman, n. sp.

Trophosome.—Hydrocaulus attaining the height of about one inch, simple or sparingly branched, the main stems springing at distinct intervals from the creeping ramified stolon; periderm with nearly obsolete transverse corrugations: polypites supported on collar-like expansions of the cœnosarc, they measure in full-sized specimens about two lines from tip to tip of the extended proximal tentacles, and have about twenty proximal and fifteen distal tentacles; body of polypites scarlet, periderm light yellow.

Gonosome.—Gonophores (male*) borne on very short branching peduncles, forming erect clusters of scarlet sporosacs, usually about three in each cluster; summit of gonophore with three rather large tentaculiform tubercles.

I obtained *T. humilis* during the autumn, attached to the rocks close to the level of low-water spring tides near the mouth of Kinsale Harbour. It resembles *T. bellis* in its mode of growth and in the shortness of its hydrocaulus; but is at once distinguished from this species by the absence of distinct annulation, and by the smaller size and less-appressed form of the polypite.

Tubularia attenuata, Allman, n. sp.

Trophosome.—Hydrocaulus attaining the height of three or four inches, slender, obscurely corrugated, very irregularly branched, with the branches given off at a wide angle: polypite supported on a collar-like expansion of the cœnosarc; distal tentacles about one-third as long as the proximal ones; body of polypite deep vermilion between the two tentacular verticils, and thence becoming paler coloured towards the enlarged base, periderm light straw-colour.

Gonosome. — Gonophores (male †) borne on short erect branched peduncles, with usually five to eight in a cluster; tentaculiform appendages of gonophores long, in mature individuals nearly equalling in length half the height of the gonophore.

T. attenuata is a deep-water species; I have dredged it from about 15 fathoms in the Firth of Forth, and from about 50 in the Shetland seas. It differs from *T. coronata* chiefly in its more diffuse habit and the short erect peduncles of its clusters of gonophores, while from the *T. simplex*, Alder, it is easily distinguished by its branched hydrocaulus and by the greater length of its distal tentacles.

* All the specimens examined were males.

† Only male specimens have been examined.

Campanulina repens, Allman, n. sp.

Trophosome—Hydrocaulus springing from a creeping stolon-like hydrorhiza, and consisting of numerous short simple stems, each terminated by a polypite, and, along with these, other more developed stems with alternate branches; hydrothecæ conical, with the margin continued by a membrane which is cut into deep acute segments, forming an operculum which closes over the orifice of the hydrotheca when the polypite is withdrawn or absent; the hydrocaulus is distinctly annulated, but the hydrorhiza is smooth. Polypites very extensile, with about sixteen tentacula, rendered nodulose in extension by irregular clusters of thread-cells; the tentacles during extension are held with the alternate ones elevated and depressed, and are united at their base by a very shallow web.

Gonosome.—Gonangia large, borne upon the creeping stolon, and occasionally also upon the hydrocaulus, about three times the length and breadth of the hydrothecæ, in the form of an inverted cone slightly gibbous at one side near the proximal end, and supported on the summit of a very short annulated peduncle. Gonophores phanerocodonic; medusæ at the time of liberation with four very extensive marginal tentacles, which are nodulated by clusters of thread-cells.

C. repens was found investing the surface of Sertularian Hydroids dredged from about 5 fathoms in the Firth of Forth. It differs from *C. acuminata*, Alder, in the hydrotheca being crowned by long, acute, converging segments, which on the retreat of the polypite form a true operculum, while the hydrotheca in *C. acuminata* is merely continued by a delicate collapsile and undivided membrane—as well as in the much slighter development of the scarcely apparent web which unites the bases of the tentacles, and in the fact that the medusa at the time of liberation has four well-developed marginal tentacles, while the medusa of *C. acuminata* has only two. Some of these characters may possibly be regarded as pointing rather to a generic than to a merely specific difference. (See my Synopsis of the Campanularian Hydroids, 'Annals,' May 1864, p. 376.)

In my Synopsis of the Tubularian Hydroids (p. 359), I proposed the establishment of a new genus, under the name of *Heteractis*, for the *Corymorpha annulicornis* of Sars. I had unfortunately overlooked at the time the fact that this name had been already employed by the botanist for a genus of composite plants—an inadvertence to which one of my pupils, Mr. W. R. M'Nab, has since called my attention. I would accordingly now propose that the new zoological genus, instead of

bearing the name of *Heteractis*, should be designated by that of *Heterostephanus* (ἕτερος, dissimilar, and στέφανος, a crown), a name which will entirely express the character which originally suggested that of *Heteractis*.

I find also that I have, by an oversight, omitted from the Synopsis the genus *Cionistes* of Dr. T. S. Wright. This is a genus of Tubularian Hydroids discovered by Dr. Wright on the Scottish coast. I have never seen a specimen; but Dr. Wright gives the following diagnosis of the genus:—

"Polypidom retiform; alimentary polypes sessile, minute, white, with a single row of short tentacles; reproductive polypes columnar, thickened towards the apex, not terminated by a cluster of thread-cells bearing many generative capsules"*.

Though the above diagnosis contains some characters which I cannot consider as of higher than specific value, there are still a sufficient number on which to found a valid genus, which will take its place in the family of the Eudendridæ. Dr. Wright records, though without description, a single species of the genus, namely, *C. reticulata*, Wright.

Under the genus *Diplura*, Greene, I have also inadvertently omitted to give the only species which has been traced to its trophosome, namely,

Diplura fritillaria, Steenstrup (sp.), = *Coryne fritillaria*, Steenst.

Mr. Alder, in a letter which I have received from him, reminds me that I have omitted to enumerate among the species of Campanularian Hydroids the *Sertularia gelatinosa* of Pallas, and the *Sertularia longissima* of the same author, both of which are placed by subsequent authors under the genus *Laomedea*. The omission of these species from my Synopsis was entirely accidental. I have no personal knowledge of their gonosomes; but Mr. Alder informs me that it is his belief that both species give off medusæ. If so, it is most probable that the medusa is of the *Obelia* type, and the two species will then go into the genus *Obelia* as defined in the Synopsis.

I have also accidentally omitted the *Campanularia fastigiata* of Alder, which is, in all probability, a *Calycella*. Mr. Alder is himself of this opinion, and is moreover convinced that his *C. fastigiata* is identical with Sars's *Lafoëa plicatilis*. It must therefore be enumerated among the species included under the genus *Calycella*, while the subsequently described *Lafoëa plicatilis* of Sars must be removed from the genus *Lafoëa*, and must take the place of a synonym of *Calycella fastigiata*.

In introducing Sars's genus *Myriothela* into my Synopsis, I

* T. S. Wright in Ann. Nat. Hist. for August 1861, p. 123.

followed Agassiz in restoring to this remarkable hydroid the name of *Candelabrum*, proposed for it by De Blainville. More mature consideration, however, has induced me to return to the name of *Myriothela*. De Blainville found that a species of this genus was described by Fabricius under the name of *Lucernaria phrygia*, and it was plain to him, as it would have been to any zoologist of that day, that Fabricius's hydroid was no *Lucernaria*; hence his proposal of a new generic name for it.

The laws of priority, if rigidly enforced, would certainly justify the suppression of Sars's name in favour of De Blainville's; but it is evident that De Blainville was utterly ignorant of the animal for which he proposes the generic name of *Candelabrum*: he asserts that it "certainement n'appartient pas au type des Actinozoaires," and he concludes his allusion to it by affirming its affinity with *Sipunculus*.

Under these circumstances I cannot but agree with my friend Mr. Alder in feeling that De Blainville's name has no claim to take the place of *Myriothela*, given to this hydroid by the eminent Norwegian zoologist, who was well acquainted with it, and to whom we are indebted for the first legitimate zoological description of it.

I have never had the good fortune to meet with a specimen of *Myriothela*; but I now learn from Mr. Alder (to whom I am indebted for drawings of the *M. arctica*, in its young and adult states), that the young leave the adelocodonic gonophores of this hydroid in a condition which closely resembles the free state of *Tubularia*; and he further suggests the probability of a close affinity between *Myriothela* and *Acaulis*. With this view, which would place *Myriothela* in the family of the *Tubularidæ* rather than in that of the *Corynidæ*, I am well inclined to agree.

II.

The Medusa of Zanclea implexa, *Alder*.

Some years ago I described the remarkable medusa of the *Zanclea* (*Coryne*) *implexa* of Alder, to whose singular pedunculated capsules, filled with thread-cells, and set along the whole length of the marginal tentacles, I called special attention *.

At the end of April last I dredged, off the Forfarshire coast, a colony of the *Zanclea*, which, after remaining for about a fortnight in a jar of sea-water, threw off its medusæ. On examin-

* Notes on the Hydroid Zoophytes, in Ann. Nat. Hist. for July 1859, p. 54. The hydroid is there named *Coryne Briareus*; I, however, agree with Mr. Alder and Dr. T. S. Wright in referring it to the previously described *C. implexa* of Alder, a hydroid which I further think must be now referred to the genus *Zanclea* of Gegenbaur. (See the Synopsis of Tubularian Hydroids, p. 357.)

ing these with a hand-lens as they floated in the water, I was struck with the appearance of a *Mucedo*-like growth with which many of them seemed to be invested. That this, however, was something very different from what it appeared to be, soon became evident; for if the little medusa was touched with the point of a needle, the whole of the flocculent mass would instantly vanish.

It needed, however, a higher power of the microscope to reveal the true nature of the phenomenon, and show that the apparently parasitical growth consisted of the enormously elongated peduncles of the thread-cell-bearing capsules, each of which, as it now proved, had the power, while still carrying the capsule on its extremity, of extending itself to a length which considerably surpassed that of the longer or vertical diameter of the umbrella.

While the medusa continued to float undisturbed through the water, the peduncle would remain projected in a straight line from the tentacle, becoming at the same time amazingly attenuated; but on the least disturbance it would become suddenly shortened to less than the one-twentieth part of its length when extended, drawing the capsule back with it in its contraction.

During the extended condition of the peduncles, they were seen, with their capsules, to be in a state of constant vibration. This was found to be due to a pencil of long, fine vibratile cilia, which, by the aid of a high magnifying power, could be detected on the summit of every capsule.

EXPLANATION OF PLATE II.

Fig. 1. *Heterocordyle Conybearei*, of the natural size, growing upon an empty *Buccinum*-shell.

Fig. 2. A portion of a colony, magnified: *a, a*, gonoblastidia loaded with gonophores and extended; *b*, gonoblastidium contracted; *c*, polypite with the tentacles partially contracted, showing that, when in this state, the tentacles assume a clavate form.

Fig. 3. A female gonophore still further enlarged.

BIBLIOGRAPHICAL NOTICES.

British Conchology, or an Account of the Mollusca which now inhabit the British Islands and the surrounding Seas. Volume II. By John Gwyn Jeffreys, F.R.S., F.G.S. &c. Van Voorst.

"Since the publication of the first volume of this work I have made two more dredging excursions to the Shetland Isles, a district which is by far the most interesting that I know of for the further investigation of the British Mollusca. In the interval I revisited the south of France, and also went to the Hanse Towns, Denmark, Sweden, and

Norway, for the express purpose of examining public and private collections of European shells, and especially the types of species described by O. F. Müller and subsequent writers on Scandinavian conchology. Every naturalist will appreciate the advantage of such an undertaking, being aware that our own fauna and flora cannot be properly studied apart from that of the rest of Europe. These preliminary remarks are offered to explain the cause of delay in the appearance of the present volume, and likewise to express my grateful acknowledgments for the kind welcome and aid which I received from all the leading zoologists in the countries above mentioned."

Such are Mr. Jeffreys's opening words in the preface to the second volume of 'British Conchology,' which we have the pleasure of introducing to our readers. The work which the author has undertaken is to him a labour of love, and he is determined to spare neither trouble nor expense in order to make it a complete history of the Mollusca of Great Britain. There is no cause to regret the interval of two years which has elapsed between the publication of the first and second volumes. It is evident that that time has been profitably spent in the accumulation of additional knowledge respecting the shells of our coast; and as we have read we have not failed to recognize repeated instances of the value of the results of the author's visit to Scandinavia and his extended dredging in the deep waters of the Shetland Seas.

The volume before us embraces the Brachiopoda (here rightly separated as a distinct class from the Conchifera) and the Conchifera from *Anomia* to *Scrobicularia*, and contains descriptions of 130 species. At the present rate of progress, therefore, we must expect that at least two more volumes will be required to complete the work. The generic and specific descriptions are worked out with great care, and the latter will be found to be both more methodical in arrangement and more concise and clear in definition than those of Forbes and Hanley. The descriptions in this latter work labour under the disadvantage of being too long; and thus, from the prolixity with which minor and comparatively unimportant details are enumerated, the student often finds himself perplexed to discover the chief characteristics which distinguish the species from its allies.

The revised list of the portion of the British Mollusca here described shows considerable diversity from that presented to us, ten years since, by the authors of the 'British Mollusca.' In the interval, Mr. Jeffreys has from time to time published in our pages papers entitled "Gleanings in British Conchology." In these papers were first made known as British many of the species which he now more fully describes in his present work. He has acted wisely, however, in reconsidering the grounds upon which he inserted many so-called species in those "Gleanings," and in reducing them again to the level of varieties; but we venture to think that, having in some instances previously gone to one extreme in species-splitting, he is now showing a tendency to the opposite extreme in striking out of our fauna several well-marked specific forms. The following lists will show the

differences between the species described by Jeffreys in his second volume and those of Forbes and Hanley:—

Species added.	*Species excluded.*
Argiope decollata, *Chemn.*	Hypothyris psittacea, *Chemn.*
—— capsula, *Jeffr.*	Anomia aculeata, *Müll.*
Pecten Testæ, *Bivona.*	—— striata, *Lov.*
Lima Sarsii, *Lov.*	Pecten niveus, *Macg.*
—— elliptica, *Jeffr.*	Nucula radiata, *F. & H.*
Limopsis aurita, *Brocchi.*	Astarte elliptica, *Brown.*
Arca obliqua, *Phil.*	—— crebricostata, *Forbes.*
Lepton sulcatulum, *Jeffr.*	—— arctica, *Gray.*
Axinus Croulinensis, *Jeffr.*	Mactra elliptica, *Brown.*
Cardium papillosum, *Poli.*	Tellina proxima, *Brown.*

Three of the additions made to our fauna—*Argiope decollata, Lepton sulcatulum,* and *Cardium papillosum*—are Mediterranean species, which have hitherto only occurred in the extreme south of the British Islands, off Guernsey; on the other hand, *Lima Sarsii, Arca obliqua,* and perhaps *Limopsis aurita* are Scandinavian forms which have now been met with in Shetland; while the four remaining shells have more extended range on our coasts.

The especial attention which has been paid of late years by geologists to the more recent deposits of our islands, and especially to those contemporaneous with and subsequent to the glacial epoch, has led to a great advance in knowledge respecting the connexion of our present fauna with that of the latest periods of geological time; nor have these investigations been confined to the land. The dredge has made known to us the fact that on the sea-bottom all round our shores there are lying, mixed with the dead and living examples of our present fauna, the shells of various Mollusca, often remarkably fresh in appearance, which have apparently ceased to live in our waters. It is often a matter of extreme difficulty to determine whether a species dredged only in a dead state be recent or fossil; and hence it happens that *Hypothyris psittacea, Astarte crebricostata, A. arctica,* and *Tellina proxima,* together with *Mya Uddevalensis, Margarita cinerea, Margarita (Skenea) costulata, Natica clausa, Astyris Holböllii, Trophon scalariformis,* &c., have been introduced among our Mollusca, but are now believed to be extinct representatives of more northern existing species, which once lived associated with our recent Mollusca, but gradually died out as the temperature of the waters which surround our coasts increased, and are now no longer to be found living in a latitude so far south.

Most conchologists will also be ready to acquiesce in the suppression of *Anomia aculeata* and *A. striata* as distinct from *A. ephippium* and *A. patelliformis*; but what shall we say to *Pecten niveus* being merged in *P. varius, Nucula radiata* in *N. nucleus, Astarte elliptica* in *A. sulcata,* and *Mactra elliptica* in *M. solida*? In writing on the first of these changes, Mr. Jeffreys says:—"I fear that some of my conchological friends will be terribly shocked at my

innovation in uniting *P. niveus* with *P. varius*; but I feel constrained to take this bold step, even at the risk of not being soon forgiven. I had for a long time great misgivings on the subject." We greatly regret that his misgivings did not last longer, and can assure him that he was quite justified in his fears, and that his "conchological friends" are "terribly shocked" at his merging the four shells named in their allied species. It is no mere individual opinion we express, but we believe it to be the opinion of all our leading British conchologists, that Mr. Jeffreys has been guilty of a most barbarous murder in the slaughter of these little innocents. Are not the grounds on which these species are reduced to the rank of varieties untenable? It is to this general question that we shall address ourselves, because the limits of a brief review do not permit of our extending our observations to the discussion of the claims of the individual forms to specific rank. There has been an axiom put forward, originating, if we mistake not, from Mr. Alder, that, "if two nearly allied forms live together under the same circumstances, without showing any intermediate forms, the presumption is that they are specifically distinct." This is a sound argument. But the converse of this by no means holds good. It is a most false argument, that, if two nearly allied forms do not occur together, this is to be received as proof of their specific identity. Yet this is the chief ground on which Mr. Jeffreys relies in his amalgamation of the above-named species. *Pecten niveus* occurs throughout the Hebrides, but *P. varius* is wholly absent from the district; *Nucula radiata* is found in Milford Haven, but "always in separate parts of the bay from *P. nucleus*." *Astarte elliptica* has never been met with by the author "on the same ground" with *A. sulcata*; and *Mactra elliptica* is regarded as a deep-water form of *M. solida*. Now we are not prepared to deny—very far from it—the existence of races; but most certainly these cannot be cited as instances of this kind of variation. The allied species in question, if we except *P. niveus*, are found constantly in the same locality, if not actually on the same ground, with the species with which Mr. Jeffreys would unite them; and they are thus associated over a considerable portion of our own seas, as well as northward or southward of them. These, we repeat, are no instances of races, which are synonymous with local varieties. Had it been true that *A. elliptica*, *N. radiata*, and *M. elliptica* *occupied a totally different area of distribution* from their allies *A. sulcata*, *N. nucleus*, and *M. solida*, then such a fact might be received as an argument that the allied forms were two races of one species. But this is not the fact. The cases before us are examples of nearly allied species which constantly coexist in the same limited area. The fact that they do not live together upon the same *ground* and have not the same *habits* must surely be regarded as an evidence in favour of, rather than against, their specific rank. Another point, which it appears to us that Mr. Jeffreys has lost sight of in dealing with these species, is that a number of minor differences become in the aggregate equal to a single more marked character.

In the formation of genera, we find that *Crenella* has been limited,

and receives only the clathrated forms *C. rhombea* and *C. decussata*, while the remaining section is placed in *Modiolaria*, Beck. Similarly *Lucina* has been divided, and its species distributed among the genera *Loripes*, Poli, *Lucina*, Brug., and *Axinus*, J. Sow. These changes appear to be for the better; but we are at a loss to understand why the same author who adopts these genera unites *Modiola* with *Mytilus*, *Artemis* and *Cytherea* with *Venus*, and *Syndosmya* with *Scrobicularia*; for the four genera which he condemns are founded upon equally valid grounds with those which he adopts.

There are two changes in specific nomenclature which appear especially to call for remark. The English *Pinna*, which has already been so frequently renamed, comes before us once more with a new title, as *Pinna rudis*. The author has given us no reason for the adoption of this name, which is remarkable, since another species has hitherto been considered to be the *Pinna rudis* of Linnæus. *Venus Gallina*, Linn., is adopted instead of *V. striatula*, D'Orb.; but Mr. M'Andrew has found these two species in company on several parts of the Spanish coast, each preserving its distinctive characters. Indeed the form of *V. striatula* from the same localities in which *V. Gallina* is found shows a greater divergence from that species than do the majority of examples of the same species as collected on our own coast.

We have now freely handled the second volume of 'British Conchology,' and called attention to points on which we are compelled to dissent from certain views which the author has adopted. Mr. Jeffreys can afford to challenge such criticisms. Indeed we have seen that he anticipated them. His work has too much sterling merit in it for him to fear the discovery of a few subjects of difference between the opinions of himself and those of his brethren of the dredge. We rejoice that a large class of persons who have hitherto been debarred from pursuing conchology by the expensive nature of the only descriptive work on the subject will now find a standard authority brought within their reach; while no experienced conchologist will be able to dispense with Mr. Jeffreys's work, or to take it up without finding its pages full of new and interesting matter.

The School-Manual of Geology. By J. Beete Jukes, M.A., F.R.S. &c. Edinburgh, 1863. 362 pages.

A Guide to Geology. By John Phillips, M.A., LL.D., F.R.S. &c. 5th edition. London, 1864. 314 pages.

Both of the authors of the hand-books before us have supplied students with larger manuals, full of sound information in the chief branches of geology; and these more complete works have passed into two or more editions, keeping up with the progress of the science. Here, then, we have geologists, of great experience and good culture, expounding and illustrating the elements of their favourite science, at large for advanced and special students, and in a less elaborate manner for the amateur and the beginner. This is as it should be. There are differences, however, in these little text-

books that characterize them as the works of different thinkers; and there are peculiarities that may interfere with the fulfilment of their intended usefulness.

Mr. Jukes's 'School-Manual' takes a three-part view of the science, namely:—1st. Dynamical geology, or geological operations now in action, prefaced with a chapter descriptive of the earth as a whole, and comprising, in the chapter on igneous rocks, a brief account of the chief rock-substances; 2. Descriptive geology, or some of the facts observable in the crust of the earth; 3. Theoretical or historical geology—the history of the formation of the earth's crust, deduced from the facts observable in it, as interpreted by the operations now going on. This is a philosophical treatment of the subject, and is very well carried out to the extent intended by the author, except in one particular. Chapter 17 treats of the three later Palæozoic periods—the Devonian, Carboniferous, and Permian periods; but whilst the last two are described and illustrated, the first is replaced by seven pages of technical argument as to whether the "Devonian" strata should have a place in the geological scale or not, geologists not having yet fully examined these beds in Devon, Cornwall, Wales, Scotland, Ireland, and elsewhere. Still the strata and their peculiar fossils do exist; and whether the divisional lines between them and the Silurian, and between them and the Carboniferous strata, are more or less distinct is of minor importance in a little book like this, where the well-known "Old Red" Fishes of Scotland and the wide-winged Spirifers and peculiar *Clymeniæ* of the Rhenish rocks should have had their woodcuts like other characteristic fossils. Although the author's chapter on the "Devonian Period" (which he does not admit) reminds one of the famous Hibernian chapter "On Snakes," and a chapter "On Oolite" in a work on the Plymouth Limestones,—the non-existence of oolite being the briefly stated fact, yet the pressing interest of an earnest and honest writer's own views and special work must be taken as an excuse for his rather pointing out difficulties in theoretical geology, in this instance, than following the usual routine of "Old Red" and "Devonian." We think, however, that a notice of the special fossils and sections, with a warning allusion to the doubts entertained as to the exact relationships of the beds, and of their value in geologic time, would have fulfilled the requirements of the case, and thus left the book free of the blemish which all schoolmasters and college-teachers must now feel that it possesses.

In spite of this, however, the 'School-Manual' is admirably adapted to attain the chief object for which it was written—namely, to impart sufficient rudimentary knowledge to excite and guide the faculty of observation with regard to rain and snow, glaciers and rivers, sea-shores and ocean-beds, hot springs and volcanos, lavas and strata, minerals and fossils, so that the young student may get hold of the groundwork of geology, and the grown-up amateur may gain from it a fair general notion of the scope and nature of the science.

Professor Phillips's 'Guide to Geology' first appeared nearly thirty years ago, when elementary treatises by Brande, Bakewell,

De la Beche, and Lyell were its associates, all honestly endeavouring "to seek the proper end of philosophy, by arranging multifarious and seemingly discordant facts into a chain of natural links." (Bakewell.) The speculative geologists had not, at that time, ceased to strongly influence the rising science; and Prof. Phillips, one among the best of observers, kept the hypothetical aspects of many a well-ordered series of facts fully in view; and now even, in his manual for beginners, instead of describing the actual composition and state of the material of which he is treating (for instance, the atmosphere, p. 17, &c.), and giving the student useful practical information about it, he rather enters into a disquisition upon what he considers it was ages ago. Thus certain long-cherished hypothetical views as to the original conditions of land, water, and atmosphere are here as unnecessarily presented for the consideration of juvenile students as the "Devonian" question is in Mr. Jukes's little manual.

In his account of geology, in the 'Guide,' Prof. Phillips first treats of the mass of the globe; 2, the crust of the earth, and its structure; 3, land and sea; 4, climate; 5, the series of life; 6, lapse of time; 7, succession of rocks in the crust of the globe, with many useful little tables; 8, lithology. He does not figure the fossils in this little book, and indeed the woodcuts of manuals are of no use for the identification of species; but he judiciously illustrates his chapter on lithology, in which all the chief rock-substances and common minerals are clearly and concisely described according to their associations.

There is no doubt that Professor Phillips's 'Guide' is fully trustworthy, being very good, though occasionally rhetorical, and often apt to deal with problems that the philosophy of geology rather dreams of than understands. The author, however, clearly states that he intends this little work to help, first, those inquiring what geologists think probable as well as certain in the history of the globe, and what the facts and reasonings are on which these suppositions and conclusions are based; and secondly, the more earnest order of inquirers—real students of nature, desirous of adding to the facts, advancing the reasonings, perfecting the conclusions, and taking part in the actual progress of geology.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Nov. 10, 1863.—E. W. H. Holdsworth, Esq., F.Z.S., in the Chair.

DESCRIPTIONS OF THREE NEW GENERA OF MARINE FISHES OBTAINED AT MADEIRA. BY JAMES YATE JOHNSON, CORR. MEM. Z. S.

Order ACANTHOPTERYGII.

Fam. CARANGIDÆ, Günther.

DIRETMUS, gen. nov.

Body much compressed and elevated, covered with small spinous

scales. Abdomen prominent and keeled. Mouth large, non-protractile; minute pointed teeth in the jaws, none on the palate; a pair of large tooth-like bony processes projecting from the anterior ends of the maxillaries, and entering the mouth between the vomer and the premaxillaries. Head, opercular pieces, and mandibular bones bearing numerous thin bony crests. Eyes large. A single dorsal fin commencing about the middle of the body over against the anal fin, both being continuous. Perfect thoracic ventral fins, with a free bony appendage at the upper angle of their roots. Pseudobranchia present. Branchiostegal membrane with seven rays. No lateral line.

The small but highly interesting fish upon which this new genus has been established appears to be allied to fishes belonging to genera some of which have been placed by Dr. Günther amongst the *Scombridæ*, others amongst the *Carangidæ*—families distinguished by him on account of differences in the number of the vertebræ. I have been unwilling to open the single specimen obtained with a view to the determination of this point, but place the genus provisionally amongst the *Carangidæ* on account of its many resemblances to *Antigonia*. It may be entered in the synopsis of the genera of that family (Cat. Brit. Mus. Coll. p. 418), in sect. β of the first group, *Carangina*, thus:—

Ventrals with a free bony appendage.

These appendages, the tooth-like processes of the maxillaries, and the crests about the head present an assemblage of characters quite sufficient to separate this form distinctly from all other known Acanthopterygian genera.

DIRETMUS ARGENTEUS, sp. n.

D. 27. A. 22. P. 18. V. 10? C. 19. M. B. 7.

The body is much compressed, and so elevated that without the tail and its fin it is subcircular. The height to the total length is about 1 to $1\frac{2}{3}$. The abdomen is prominent and keeled, and the nape is trenchant. It is of a silvery-grey colour, with darker grey near the dorsal and anal fins. The skin, when the scales are removed, is fuscous. The whole body is clothed with small, somewhat deciduous scales, having four or five broad teeth at the edge and some minute spines on the exposed surface. Each scale is constricted at the middle; the posterior portion is rather larger than the anterior, and marked with curved transverse striæ. The *head* is large, being contained in the total length only about $2\frac{2}{3}$ times. It is remarkable for the numerous crests of thin bone, many of which are minutely denticulated. The cheeks are scaly; but the opercle and maxillary are without scales. The *eye* is round and large, its diameter compared with the length of the head being as 1 to $2\frac{1}{5}$. It is placed high up, a diameter and a half above the throat, but does not quite reach to the profile, and a space equal to less than half the diameter intervenes between it and the muzzle. A thin bony crest is placed behind it, and another in front of it, the latter forming a funnel-shaped cavity below the rather large nostril. Between the eyes there are three low crests without serratures, the middle one of which di-

vides behind. The muzzle is short and obliquely truncate; the lower jaw remarkably deep, and projecting beyond the upper, with an acute boss at the symphysis. The upper border of the mouth, which is strongly oblique, is formed entirely of the slender premaxillary, carrying a double series of minute teeth which are sharp and slightly curved, and reduced in front to a single series. Similar teeth are placed in a single row in the lower jaw. The small tongue, the palatines, and prominent vomer are toothless; but from the upper ends of the maxillaries there projects into the mouth a pair of large tooth-like bones that are compressed, somewhat falcate, and blunt at the tips. The tongue, pharynx, and inner sides of the gill-covers are deep black. The maxillary is extremely broad below, and reaches to within a quarter of the diameter from the vertical from the posterior border of the eye. The dilated portion has numerous radiating crests, which are minutely denticulated. The mandibular bones also carry denticulated crests. The seven-rayed branchiostegal membrane is completely concealed by the gill-covers. There are no toothed processes on the œsophagus, nor any folds of skin on the palate. The *opercle* is high, the width, from back to front, being less than one-third of its vertical length. There is an elevated crest at its anterior margin, which is minutely toothed; and the rest of its surface is furnished with numerous simple crests that radiate from a point high up near the anterior margin. The free edge of the opercle is even. The preopercle is narrow, and its lower margin is denticulated; some of its crests are also denticulated. The interopercle is large, and projects beyond the throat; it bears numerous crests, that are denticulated and form small sharp teeth at the margin. The gill-openings are wide; pseudobranchiæ are present; the first free pair of gills carries a series of spiny rakers of moderate length.

The single *dorsal* fin is moderately long, and commences over the vent, somewhat in front of the middle of the back. It appears to be higher in front, and to be destitute of scales. All the rays, except perhaps the last two or three, seem to be simple spines. They are stout, closely set; and the first five are compressed, with minute teeth at their edges; the remaining spines of the fin have also teeth at their edges. It terminates at the end of the curve of the back, where the parallel-edged tail abruptly commences. The *anal* fin is rather shorter than the dorsal fin; their terminations are in the same vertical. The rays seem to be of the same structure, with spinous edges; but it seems not to have been higher in front. The *pectoral* fin is rather long (about one-third of the total length), rounded at the tip, and inserted below the middle of the height on a level with the bottom of the opercle. The first ray is less than one-third of the second; the fourth ray is slightly the longest; the rays begin to shorten rapidly with the seventh. All except the first two are branched, and these are denticulate on their anterior edges. Several of the others are also denticulate at the sides. The thoracic *ventral* fins are placed slightly behind the root of the pectoral fins. They reach back at least as far as the commencement of the anal fin, but are apparently

not elongate. Some of the rays have denticulate edges. At the upper base of each fin there is a free white ovate appendage of bone, nearly seven times as long as wide, resembling in shape the wings of some insects. The surface is obliquely striate, and the sharp edge of the anterior margin is set with a few distant minute teeth. At its base there is a small process directed backwards. The *vent* is in front of the middle of the total length, and the anal fin begins immediately behind it. The *tail* is compressed, and a little longer than high. The caudal fin is forked.

There is no lateral line. A series of about sixty scales may be counted between the opercle and the caudal fin, and about fifty in the height.

The individual was obtained in the month of January. The vertical fins appeared to have suffered damage, and nothing can be positively asserted in regard to certain points which it is desirable to know, such as the height and outline, and the structure of the rays. Neither could it be ascertained whether they had been covered with scales; but it may perhaps be inferred, from the spinous sides of the rays, that this had not been the case. The rays of the ventral fins seemed to be ten; but whether these were really only five rays split to their bases I could not make out with any degree of certainty. No connecting membrane was to be seen between the first five spines of the dorsal fin, but it may have been removed by accident. The fish had fed on animal food.

The following table shows the dimensions of the principal parts of the specimen, which has been sent to the British Museum:—

	inches.
Total length (caudal fin somewhat mutilated)	$3\frac{8}{10}$
Length to commencement of tail	$2\frac{6}{10}$
Height	$2\frac{3}{10}$
Thickness at shoulder	$\frac{4}{10}$
Head, length	$1\frac{4}{10}$
Mouth-cleft, depth	$\frac{5}{10}$
————, width, nearly	$\frac{4}{10}$
Premaxillary, length	$\frac{9}{10}$
Maxillary, width of lower end................	$\frac{5}{10}$
Eye, diameter	$\frac{6}{10}$
Opercle, height	1
Dorsal, distance from muzzle	$1\frac{7}{10}$
——, length of base	$1\frac{3}{10}$
Pectorals, length	$1\frac{2}{8}$
———, distance from muzzle	$1\frac{3}{10}$
Ventrals, distance of their roots from roots of pectorals	$\frac{7}{10}$
Appendage of vertical fins, length	$\frac{7}{10}$
————————, width, rather more than	$\frac{1}{10}$
Anal, length of base..........................	$1\frac{1}{10}$
Tail, length	$\frac{4}{10}$
——, height	$\frac{3}{10}$
Caudal fin (mutilated)........................	$\frac{7}{10}$

Order MALACOPTERYGII.

HALOSAURUS, gen. nov.

Body elongated, clothed with cycloid scales; belly rounded; tail compressed and tapering to a point. Snout projecting much beyond the mouth, which is non-protractile and of moderate size, with the upper border formed by the premaxillary and maxillary bones, the former small, the latter of moderate size and not reaching beyond the eye, both dentiferous. Teeth in villiform bands, in the jaws and on the vomer, palatines, and tongue. A short dorsal over the space between the abdominal ventrals and the long anal, which is coalescent with the caudal, the latter consisting of very few rays. Large gill-openings. Branchiostegal membrane with numerous rays. Stomach cæcal; pyloric cæca in moderate number; a large air-bladder.

No pseudobranchiæ, no barbel nor adipose dorsal.

HALOSAURUS OVENII.

D. 11. P. 11. V. 10. A. 191! C. 2. M. B. 14. Scales of lateral line about 170.

Body elongated, compressed, attenuating in both directions from the neighbourhood of the dorsal fin, the tail becoming filiform; the belly rounded, except in the neighbourhood of the ventral fins, where it is flattened. Clothed with cycloid scales of a moderate size. The height compared with the total length is as 1 to $14\frac{1}{6}$. The back and sides are brown, the middle of each scale being bluish grey with minute black dots. The belly is grey.

The *head* has something of the aspect of that of a *Macrourus* or a *Coilia*, the mouth being on the underside. Compared with the total length it is as 1 to $7\frac{1}{2}$. It is unarmed, scaly, slender and depressed, with a projecting snout. At the back there is a transverse narrow scaleless groove, which curves forwards slightly. The lateral *eye* is oval, with an angle before and behind. Compared with the length of the head it is as 1 to 5. It reaches to the profile, and is distant from the snout nearly two of its longer diameters; and the space between the eyes is less than one of such diameters. The snout is curiously formed; it is much depressed and narrows forwards, but the extremity is rounded. There is an undulating crest near each edge above, and another at each side below, with a mesial keel underneath. It is scaleless, and covered with a soft gelatinous skin. There is a crest across the cheek below the eye, and a groove extends forwards from the inferior margin of the orbit at each side of the snout.

The moderate-sized *mouth* does not reach nearly to the tip of the snout. Neither jaw is in the least protractile. The anterior portion of the upper border is formed by the premaxillary, the remainder by the maxillary, and both bones are set with a band of minute sharp villiform teeth. There is a crest along each border of the maxillary; and that at the posterior margin projects as a tooth, which reaches to the orbit. The maxillary is simple, not composed of three pieces as in the *Clupeidæ*. The mandible is set with teeth similar to those before described. There are no teeth on the vomer;

but the short palatines (which come into contact in front) bear minute teeth, and in a line with them behind are the entopterygoids or pterygoids with narrow bands of minute teeth. The rakers of all the branchial arches carry similar teeth. On the hinder part of the tongue, which is black and free at the tip, there is an ovate patch of minute teeth. The mouth is black, as well as the inside of the gill-covers. The gill-openings are large, and the gills consist of four pairs. The subopercle is thin, scaleless, and striate; it projects backwards considerably beyond the opercle, which is scaly, with a rounded even edge. The margin of the preopercle is concealed in the scaly skin. The two orifices of each nostril are small and near together. There is a small cuticular tag at the margin of each orifice.

The triangular *dorsal* fin is placed over the space between the ventral fins and the vent. There are scales on the membrane between the rays. The second and third rays are the longest, and are about twice as long as the base of the fin. The first ray is unbranched, and is only half as long as the two next. The *pectoral* fins are scaleless, pointed, and longer than the ventral fins. They are inserted in the upper half of the height, and have narrow bases. The abdominal *ventral* fins are distinct, but inserted close together; they are scaly, truncate, and the first two rays are unbranched. At the outer angle of the base there is a thin pointed scale. The *vent* is placed in the anterior half of the total length of the fish, and has no papilla near it. The *anal* fin is high throughout, but is higher in front than behind. The first three rays are unbranched; the base is scaly, and the fin extends with numerous rays up to the *caudal*, which is represented by two hair-like rays.

The *lateral line* is very low down, and commences at the lower angle of the subopercle. It follows a straight course until it reaches the lower edge of the body, where it is lost. About 170 scales may be counted in the length of the body between the opercle and the tip of the tail. In the height of the body there are twenty-two scales, of which five are below the lateral line.

The single individual obtained was caught in the month of February. It was a female with eggs, which lay in two masses side by side, $5\frac{1}{2}$ inches long, uncovered with a sac. The cæcal stomach was small, and contained nothing but a little much-digested matter. There were twelve small pyloric cæca, which increased in length backwards. The air-bladder had a delicate silvery coat, and was 5 inches long. The liver had a length of $1\frac{1}{6}$ inch. The intestine was straight. The peritoneum was black anteriorly; posteriorly there were patches of black lines on a pale ground.

The following are the dimensions of the specimen, which is now in the British Museum:—

	inches.
Total length	$18\frac{5}{16}$
Height between dorsal and ventral	$1\frac{3}{10}$
Head	$2\frac{7}{16}$
Eye, longer axis, nearly	$\frac{1}{2}$

	inches.
Eye, distance from tip of snout	$\frac{19}{20}$
Eyes, distance apart........................	$\frac{7}{20}$
Dorsal, length of base	$\frac{7}{10}$
———, height	$1\frac{1}{4}$
———, distance from snout..................	$5\frac{3}{8}$
Pectorals, length	$1\frac{5}{8}$
————, width of base	$\frac{1}{5}$
————, distance from snout................	$2\frac{1}{2}$
Ventrals, length	1
————, distance from snout	$4\frac{6}{10}$
Vent, distance from snout	$7\frac{7}{8}$
Anal, height of fourth and the neighbouring rays ..	$\frac{4}{5}$
Caudal, two rays	$\frac{4}{10}$

This species is dedicated to Professor Richard Owen, Superintendent of the Natural History Departments of the British Museum, whose investigations in regard to the skeleton of fishes are not the least valuable part of his many contributions to zoological science.

Chiasmodon, gen. nov.

Body naked, elongate, with two perfect dorsal fins, one anal fin, simple thoracic ventral fins, and distinct caudal fin. Head unarmed and exappendiculate. Snout short, truncate. Cleft of the mouth very long, extending much beyond the eyes. Acute teeth in two series in the premaxillary and the mandible, those of the inner series being moveable. Hooked teeth, and teeth that cross each other from opposite sides of the mouth in the upper jaw. Teeth on the palatines, but not on the vomer. Eyes lateral. Gill-openings large; four pairs of gills. Seven branchiostegal rays. No pseudobranchiæ: no anal papilla. An air-bladder.

Chiasmodon niger, sp. n.

1st D. 11. 2nd D. 13. A. 17. P. 12. V. 6. C. 14. M. B. 7.

Body black, naked, moderately elongate, compressed, and slender. Head unarmed, thick, subcubical, depressed, with a wide groove between the eyes, and two low ridges which meet in front of them. Cheeks flat; opercle rounded behind, with a notch at the junction of the subopercle and interopercle. Eyes lateral, nearly round, placed about a diameter from the muzzle (in front of the middle of the upper jaw) and about the same distance apart, with the orbit taking part in the profile. The hinder nostril, which is the larger, is placed very near the orbit. Muzzle short, truncate, subemarginate; the under jaw somewhat longer. Mouth-cleft slightly oblique, long, extending much beyond the eyes; the upper border formed entirely of the slender premaxillary, the toothless maxillary being a little dilated at the ends. Two series of subulate teeth in each jaw, those of the inner series being longer, but fewer in number. At the fore end of the upper jaw are two long immoveable hooked teeth, which are inclined towards each other and nearly meet. At the base of each is a minute sharp tooth. Next to the hooked pair is a pair of cur-

ving teeth, which cross one another from opposite sides of the mouth; these are moveable, and are the longest teeth in the upper jaw. At the fore end of the lower jaw there is a pair of very small teeth in front of a larger pair of immoveable teeth, which curve outwards. Next to these are two pairs of still longer moveable teeth, the hinder pair being the longest in the mouth. The other jaw-teeth are much smaller. On the palatines there is a series of small pointed teeth, and the middle line of the tongue is serrate. The vomer is prominent, but toothless. The tongue is grey, narrow, and free near the tip. There is no barbel, nor are there any pseudobranchiæ.

The anterior *dorsal* fin has eleven weak unbranched rays. It commences over the posterior edge of the opercle; and its base is rather less than half the length of the head, its height being about the same. The second dorsal fin is separated from the first by a space equal to about one-third the length of the head. It has a trapezoidal shape, and a longer base than the first dorsal. Its height in front is rather more than half the length of the head. The fourth and fifth rays are rather longer than their neighbours.

The pointed *pectoral* fins are inserted in a line with the eyes, and reach back to the commencement of the second dorsal fin.

The thoracic *ventral* fins are only about half as long as the pectoral fins; their apices are truncate, the first ray being the shortest. All the rays are weak, and none are detached.

The *anal* fin commences about the middle of the total length of the fish, under the fifth or sixth ray of the second dorsal fin. The length of its base is equal to about two-thirds of the length of the head. It becomes low behind. The first ray is short; the second only half as long as the third; the sixth and seventh are the longest.

The *caudal* fin is furcate, and equal in length to two-thirds of the length of the head. There are about fourteen principal rays, with a few small ones at each side.

The *lateral line* is oblique in the pectoral region, but for the greater part of its length is straight along the middle of the body.

An air-bladder of moderate size is present. No anal papilla was observed.

A single example of this new genus of Malacopterygian Fishes was taken in the month of March, and has been deposited in the British Museum. Its stomach contained the doubled-up body of an entire fish nearly twice its own length. The latter proved to be a specimen of *Gonostoma denudata*, Bp. (Faun. Ital. iii. 138), as stated in one of my papers on rare Madeiran Fishes, printed in the 'Ann. & Mag. Nat. Hist.' 1862. The stomach of the fish now described was so much injured that some points of its structure could not be made out. The greatest height of the fish could not be accurately determined, nor could the precise situation of the vent be ascertained. The stomach appeared to be capable of great extension. The rays of the first dorsal fin were unconnected by any membrane, which, however, may have disappeared through rough treatment. The teeth forming the outer series in the upper jaw were about twenty-four on each side, exclusive of the longer teeth

in front; of the inner series only two or three could be counted, others had probably been present. The outer row in the lower jaw consisted of about sixteen teeth on each side, without counting the long ones in front.

The following are the dimensions of the specimen:—

	inche
Total length	$3\frac{7}{10}$
Height over middle of anal, rather more than	$\frac{3}{20}$
Head, length	$\frac{9}{10}$
——, height	$\frac{4}{10}$
Eye, diameter	$\frac{1}{5}$
Maxillary	$\frac{7}{10}$
Teeth, length of fourth pair under jaw	$\frac{3}{20}$
First dorsal, height and length of base	$\frac{4}{10}$
—— ——, distance from muzzle	$\frac{9}{10}$
Second dorsal, distance from muzzle	$1\frac{6}{10}$
—— ——, distance from first dorsal	$\frac{1}{10}$
—— ——, length of base	$\frac{13}{20}$
—— ——, height	$\frac{5}{10}$
Pectorals, length	$\frac{6}{10}$
——, width of base	$\frac{1}{10}$
——, distance from muzzle	1
Ventrals, length	$\frac{7}{20}$
Anal, distance from muzzle	$1\frac{8}{10}$
——, length of base	$\frac{6}{10}$
——, height in front	$\frac{5}{10}$
Caudal, length	$\frac{6}{10}$
Air-bladder, length	$\frac{1}{2}$

MISCELLANEOUS.

Migration of Lemmings.

To the Editors of the Annals of Natural History.

Gentlemen,—In a recent Number of the 'Annals and Magazine of Natural History,' the subject of the migration of Lemmings was discussed, and some causes of it, propounded by M. Guyon, mentioned, none of them being quite satisfactory.

I have discovered that rats in England frequently abandon good quarters, where they have plenty of food and are unmolested by man or carnivora, and that the cause of their doing so is that they are plagued with insect vermin—fleas, lice, and ticks.

Knowing that insects are a plague to man in Lapland, I beg to suggest the question whether the occasional migrations of Lemmings may not be caused by the unusual abundance of insect vermin of the above-mentioned or other kinds.

Perhaps I may mention here something I have observed about Dormice. In some parts of Suffolk they are very numerous, and are called *Sleep-meece* by the labourers. In other parts, if turned off in woods equally abounding in oaks and hazel, they seem not to in-

crease, and finally disappear. In the woods in which they abound I have found the earth-nut (*Bunium flexuosum*) very common, and have observed that its tubers are frequently scratched up and devoured by some small animal in the latter part of spring. I suspect (for I have not seen them in the act, nor indeed is it likely that a crepuscular animal would be seen at work) that this is done by Dormice, and that there must be plenty of earth-nuts, as well as of acorns and hazel-nuts, for the Dormice to be numerous.

I am, yours truly,

Edward Gillett, M.A.
Vicar of Runham.

Vicarage, Runham, Filby, Norwich,
May 20, 1864.

Examination of the Structure of the Hair-follicle in Man and in the Rabbit. By Dr. Wertheim.

The author's investigations of the structure of the hair-follicle in man and in the rabbit have led him to the conclusion that the follicle is not a blind sac embracing the hair, but a calyciform structure which is borne upon a peduncle of considerable length, so that its similarity to the cup and stalk of a flower is very striking. The peduncle finally passes over into one of those fibres which run in great numbers through the reticular part of the corium and the subcutaneous areolar tissue in a more or less horizontal direction. Observations made upon series of parallel transverse sections show clearly that this structure is a normal one, and common to the hair of all parts, and that it is not identical with that long since described by Professor Langer, and regarded by him as standing in close relation to the change of hair. In a transverse section of the peduncle three concentric layers are observed; these are described by the author as the pith, sheath, and cortical layer of the hair-peduncle.

In conclusion, Dr. Wertheim states that for the purpose of hardening organic tissues, especially the skin and the preparations referred to in his memoir, he has employed aniline, and that he has found this substance very advantageous in several respects.—*Bericht der Akad. der Wiss. zu Wien*, 28 *April*, 1864, p. 74.

On Independent Movements of Embryonal Cells observed in the Ova of the Frog (Rana temporaria). By Dr. Stricker.

When examined in a fresh state, without the addition of reagents, and under circumstances which protect the preparation from evaporation, the embryonal cells of the ova of the Frog exhibit peculiar movements. They send forth processes, and retract them again; sometimes they become elongated, and then again round. These changes implicate the whole cell-mass, and last only for a few minutes; then the well-known structureless humps protrude themselves, which were formerly regarded as diverticula of the cell-membrane caused by diffusion. As, however, no reagent was employed, the author considers that diffusion has nothing to do with the production of these humps, which he regards as also manifestations of the life of the cell. Dr. Stricker adds some observations on seg-

mentation, which induce him to adopt the notion of M. Schultze, that segmentation is due to a contractility of the vitellus.—*Bericht der Akad. der Wiss. zu Wien*, 28 *April*, 1864, p. 75.

On globular Cell-thickenings in the Envelope of the Roots of some Orchideæ. By Dr. H. Leitgeb.

The cellular stratum beneath the envelope of the aërial roots of tropical Orchideæ always consists of two kinds of cells—namely, elongated and usually thick-walled cells, and shorter ones which are *always* thin-walled. The walls of the cells of the root-envelope adjacent to this stratum are always thickened in a peculiar manner, and the structure of these strata of thickening, again, is usually different in the walls situated upon the thin-walled cells and in those adjacent to the elongated cells. On the former several superimposed strata may not unfrequently be recognized; and these, in some plants belonging to the genus *Sobralia*, acquire so great a development as to form pretty large spherules, often occupying nearly the whole cell. Oudemans, who first mentioned these spherules, regarded them as foreign bodies; but, from careful anatomical investigation, as also from their behaviour with reagents, they must be regarded as accumulated thickening layers—a view which is also established most indubitably both by the history of their development and by comparison with other similar structures. From the circumstance that these spherules are produced by the superimposition of several thickening layers, each of which proves to be a network formed of numerous intercrossing fibres, we must ascribe to them a porous character, and it is probably in this property that their physiological significance consists. Thus, as porous bodies, they have the power of taking up the water condensed by the envelope of the root, and of retaining it for a considerable time, so as to furnish it gradually to the subjacent conical (thin-walled) cells; in this way they acquire, to a certain extent, the function of reservoirs of water, which are necessary for these plants, as they do not grow in moist primæval forests, but in the open ground, and throw out their roots upon the surface of the sandy soil.—*Bericht der Akad. der Wiss. zu Wien*, 10 *March*, 1864, p. 51.

Notice of a new Squirrel from Natal. By Dr. J. E. Gray, F.R.S. &c.

Sciurus ornatus.

Back dark blackish grizzled; hairs red, with a broad black subterminal band and a white tip. Head, legs and thighs, underside, and tail very bright red-bay; the hairs of the head, limbs, and belly red to the base; the hairs of the tail very vivid and dark red for more than half their length; the base, especially of those near the lower end of the tail, black, with two broad greyish bands.

The red colour of the female not quite so bright and dark, and the base of the tail grizzled, with shorter red tips to the hairs.

Hab. Natal (*W. Fosbrooke, Esq.*).

This species is about the size of the Common European Squirrel. —*Proc. Zool. Soc.* Jan. 12, 1864.

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IX.—*Observations on the various Species of* Glyptodon *in the Public Museum of Buenos Ayres.* By Hermann Burmeister, M.D., Ph.D. &c.*

The soil of the province of Buenos Ayres is one of the richest deposits of fossil bones on the surface of the globe. Considering that the existing specimens, of intrinsic and of scientific value, had almost all been transferred to European museums, and that it would be an easy task to found a more precious collection in Buenos Ayres, if the national administration should interest itself in the preservation of the natural treasures, I accepted the invitation which, through the medium of the Prussian Minister, Herr von Gulich, the Supreme Government sent to me during the time of the administration of Señor Sarmiento. As Director of the Public Museum, I resolved to devote myself exclusively in future to the study of the natural productions of Buenos Ayres and of the other Argentine provinces. During the two years that I have been occupied in this new employment, the Museum of Buenos Ayres has completely changed its contents: I have arranged them in the European manner, as the collections exist in that part of the world; and I have, up to this time, introduced so many new specimens of fossil bones, that, without exaggeration, it may be said that no European museum is more rich in these than that of Buenos Ayres. To prove the correctness of this statement, I shall publish, from time to time, notices and scientific descriptions of the principal specimens, commencing with our skeleton of *Glyptodon*, which,

* Translated from the 'Revista Farmacéutica de la Sociedad de Farmacia nacional arjentina,' 1863-64, by C. Carter Blake, F.G.S., F.A.S.L. [The translator has had the advantage of a copy in which Dr. Burmeister has introduced many manuscript corrections into the original Spanish printed text, and of illustrative photographs and pencil drawings of the specimens.]

up to the present time is unique in the museums of the civilized world. Señor Don David Lanato having presented this precious specimen to the Public Museum, I set it up myself, during the first months of my direction (1860), with the assistance of some friends and skilled workmen, who helped me in the steel- and iron-work, I myself superintending their manual labour. To clearly explain the parts of this antediluvian animal which are new to science, and those which are already known, I must give some historical notices of previous publications on the same subject.

The first notice of this animal will be met with in the work of the celebrated Cuvier*, in which that author states, in a note, that Señor Damaso Larrañaga, of Montevideo, discovered in Banda Oriental the shell of a gigantic animal, which probably belonged to *Megatherium*. The Prussian traveller Sellow was the first who (in the year 1825) sent specimens of this shell to Europe, where they were described by the celebrated mineralogist Weiss, in the Transactions of the Berlin Academy for 1827, without a knowledge of the zoological affinities of the animal to which they belonged, the author being, however, disposed to regard them as the armour of *Megatherium*—an opinion which, some years after, was directly accepted and published by the English author Clift†. Buckland, in his 'Geology'‡, expressed the same opinion. With the specimens of the shell which were then obtained, some parts of the skeleton were also sent to Berlin, and, with those which were examined by my friend and colleague in the University of Halle, Dr. D'Alton, this celebrated anatomist published, in the Transactions of the Berlin Academy for 1833, the description of the incomplete forearm and some foot-bones of this animal, he calculating that it bore an affinity to the Armadillo, but that, until the entire form was discovered, it would be futile to assign to it a specific name. The celebrated English anatomist Owen coincided in this judgment, five years after, when he described the shell and some portions of the skeleton which had been recently sent to London by Charles Darwin and by the English Minister in Buenos Ayres, Sir Woodbine Parish§, and gave to it the new name of *Glyptodon clavipes*, derived from the carved [or fluted] form of the teeth and the thick form of the feet. To the description of these parts the author has made several additions in his work on the fossil bones in the collection of the College of Surgeons of Lon-

* Recherches sur les Ossemens Fossiles, &c., vol. v. part 1. p. 191, ed. 1823.

† Notice on the Megatherium, Trans. Geol. Soc. 1835.

‡ Bridgewater Treatise. 8vo, London, 1837.

§ Trans. Geol. Soc. vol. vi. p. 81; Zoology of the Beagle, vol. i.

don*, and also introduces three new species, which he terms *Glyptodon ornatus, G. tuberculatus,* and *G. reticulatus,* founding the specific differences on the varied form of the plates of the surface of the shell. But as the foot of the animal described in the last publication of Owen was incomplete, Müller, the celebrated physiologist of Berlin, published a fresh description of the entire foot in the Transactions of the Academy of Berlin for 1846.

All these descriptions were founded on specimens discovered in the province of Buenos Ayres or in the Banda Oriental. There are undoubtedly remains of the same animal in other parts of South America, but in no other part of the world. In Brazil, a Danish naturalist, the learned Dr. Lund, occupied himself for a long time in the study of the fossil bones discovered in the natural caverns of Minas Geraes. Amongst these, remains of the *Glyptodon* were discovered by him; but as he was not aware of the works recently published in Europe, he described the animal under a new name, terming it *Hoplophorus,* from the "strong shell," and signalized three species, *Hoplophorus Sellowii, H. euphractus,* and *H. minor*†. A year afterwards, he published in the same 'Transactions' (vol. ix. 1842) the description of new fragments, and amongst others the teeth, and the five sacral vertebræ in one piece.

Such was the state of the scientific knowledge of *Glyptodon* before the publication of the work of M. Nodot, Director of the Public Museum of Dijon in France, to whom a French resident had transmitted from Buenos Ayres many portions of the *Glyptodon* and an almost complete shell. This work has not yet fallen into my hands, and for this reason I am ignorant of its contents excepting from the notices in scientific journals, which state that its author recognizes fourteen species of *Glyptodon,* dividing them into two divisions, *Glyptodon* and *Schistopleurum,* founded respectively on the *Glyptodon clavipes* and the *Glyptodon tuberculatus* of Owen. To the *Glyptodon* belong twelve species, which are again subdivided into two groups by the form of the tail, which in some is short and conical, and in others is long and cylindrical.

Finally Prof. Huxley, of the College of Surgeons of London, has published some notices on an incomplete skeleton presented to the Museum of the Royal College of Surgeons by Señor Don Juan Nepomuceno Terrero, of Buenos Ayres; and the brother of this gentleman, Don Federico Terrero, has published a translation of Huxley's description in the 'Nacion Argentina' of the 1st of July of the current year, to which he has added some

* Descriptive Catalogue of the Collection of the Royal College of Surgeons, vol. i. London, 1845.

† Trans. Royal Academy of Copenhagen, vol. viii. 1841.

supplements in the same periodical of the 25th of July, referring to the general description of the specimen in our museum, published by me in the 'Nacional' of last year, No. 3140.

Entering now upon the description of the specimens in the Public Museum of Buenos Ayres, it appears to me necessary to keep in mind that the number of species in our formations are not more than three, which are distinguished by the structure of the plates on the surface of the shell, and even by the general form of the shell itself. These plates form regular hexagons in the centre of the buckler, changing at the sides into prolonged hexagons, and very often into pentagons at the edges. In the same manner the hexagonal figures are arranged on the surface of each plate. There are seven on each plate, one (the largest) in the centre, and six on the six sides, which are in contact with the contiguous plates to form other hexagons on the joints between them. These figures are separated by grooves, and in these are discerned, in the corners of a median hexagon, small apertures to receive the roots of the long hairs which pass through the shell of the living Armadillo. The surface of each hexagon is rough like a file; and upon this asperity a smooth horny shield existed, as in the existing Armadillos. But the size of these hexagons of each plate varies in the different parts of the shell, those in the centre being relatively more equal, and the peripheral portions more unequal, in such manner that the central hexagon of the plates occupies more space towards the centre of the shell, whilst these proportions diminish towards the edges. It results that the last plates at the edge of the shell form large, nearly circular hexagons, and in the circumference alone are some very small figures which form the half of the peripheral hexagons. In this way the collocation of the loose plates in the whole shell can be ascertained; but in no way are we able to constitute specific differences on the form of the entire plates or the figures on their surfaces.

The same difference between the size of the central figure and the peripheral ones of each plate may also be recognized in some existing Armadillos, as in the Mulita, which possesses the same structure of the shell—a fact which is demonstrable on the smooth horny scutes which cover the hexagonal pattern of the plates.

These existing animals are to be met with in South America alone, like the antediluvian *Glyptodon* of other times, and are divisible into two principal classes. One, which naturalists term *Dasypus*, comprises such species as the Peludo (*D. setosus*), the Mataco (*D. conurus*), and the Pichy (*D. minutus*), with plates almost equal in all the parts of the shell, and covered with smooth horny scutes of the same pattern and size. If some,

like the Peludo, have large hairs on their shells, these hairs issue from the junction of the plates. The others, which are termed *Praopus,* such as the Mulita (*P. hybridus*), have plates more or less unequal, covered with two classes of horny scutes, one large one in the centre on each side, and six smaller at the junction of the plates. In these, the hairs which issue from the shell do not proceed from the joints, but from the same plate in the circumference of the central scute.

The description of the shell of *Glyptodon* demonstrates that this antediluvian animal was constructed on the same principle, but that it resembled *Praopus* more than *Dasypus*; nevertheless there is a difference between *Glyptodon* and *Praopus,* in consequence of the absence of the moveable rings in the middle of the shell, which the living Armadillos possess in varied number in the different species.

There is an important difference in the surface of the shell between *Glyptodon tuberculatus* and other species, *G. tuberculatus* not possessing the large hexagonal figures in the plates common to the other species. In *G. tuberculatus* the surface of each plate is covered equally with small irregular figures, upon which, without doubt, were placed concomitant horny plates, so that the superficies of the shell exhibits the same appearance. Some small holes amongst the small figures demonstrate also the existence of hairs in the shell, but they are more sparse, although each plate also, in its original formation, appears to have possessed six small apertures on its surface. On the edge of the shell are seen large hemispherical or conical tubercles, externally very rough, and covered with a smooth horny shield of the same form. The size of these tubercles varies according to their position in different parts of the edge, increasing in size towards the posterior part. On the shoulders chiefly these tubercles are more conical and sharp than those on the head and sides, where it appears to me there are some smaller and more conical moveable tubercles, below the edge of the shell and upon the legs. I have many of these tubercles in the Museum, but I am ignorant of their collocation on the body of the animal; nevertheless M. Nodot states that his *Schistopleurum* had moveable rings at the side of the shell, which he has not recognized in any *Glyptodon* of the Museum, unless in the above-mentioned smaller tubercles. These, by the form of their basal parts, demonstrate that they are placed on the same *cutis,* and are united to other parts of the shell.

As a general character of the whole shell, it may be observed that the central plates become in time united in an entire piece, whilst those of the side are separated and united one to the other by joints. This separation of the plates continues until

the adult state of the animal, and for this reason the shells are generally fractured or broken on the edges. Complete shells, with all the parts and tubercles on the edges, are very scarce, and rarer in proportion to the youth of the animal.

As regards the specific differences between the Glyptodons of this country, I cannot distinguish amongst our rich collection of Buenos Ayres more than three—*G. clavipes*, Owen, *G. tuberculatus*, Owen, and a species which I provisionally name *G. spinicaudus*, for want of the original works which describe other species.

The most abundant amongst these three species is the last, of which we have in the Museum an almost entire shell, a complete skeleton, and more or less important remains of three individuals. The species is distinguished easily by its short and conical tail, having seven rings of large conical tubercles; and for this reason I have given it the name of *G. spinicaudus*. Probably the *G. ornatus* is identical with this species. As the shape of the tail is the most important feature, we shall begin with its description.

It is 22 inches in length, 14 in width at the base, and 4 at the apex, which is obtuse and round. At the base are seen six rings of conical tubercles, which are more or less narrow. Each ring is composed of three bands of plates, the last one being formed of the great tubercles, whilst the two preceding ones are smooth, and almost wholly covered by the anterior rings. The first ring is the largest, and of a transversely elliptical shape, having twenty-three tubercles on the posterior edge, the nine lower ones being smooth, and the upper ones more elevated into a conical point according as they approach the middle of the dorsal surface. The second ring is of an almost circular figure, and with eighteen tubercles on the edge, the inferior surface being smooth in almost all the lower rings. In the same manner, the third ring has fifteen, the fourth eleven, the fifth nine, the sixth seven tubercles; and the extreme portion is formed by a ring of five, including amongst them three at the apex itself. Of all these tubercles, those of the middle of the dorsal surface are always the largest, and prolonged into a conical point. The shell of this species is in its general form more spherical than that of some of the others. Its length, following the curve, is about $3\frac{1}{2}$ yards (*varas*), and its width about $2\frac{1}{2}$; only the posterior part near the tail is a little uncovered; the longitudinal diameter is $5\frac{1}{3}$ feet, and the transverse diameter is about $3\frac{1}{4}$. The surface of the plates is very rough, much more so than in the other species, and the size of each plate smaller. The central hexagon of the dorsal plates of the shell is smaller than in *G. clavipes*, and for this reason the difference between the central

figure and those of the periphery is little or nothing: all the hexagons of this central part of the shell are of equal size.

Also the tubercles of the edge of the shell are smaller and different in shape; these tubercles have, in *G. clavipes*, a low conical elevation on the external surface, which is wanting in *G. spinicaudus*. In this species are seen about sixteen tubercles at the posterior edge of the shell over the tail, and about twelve on the anterior edge over the head. The lateral tubercles are almost wholly wanting, and for this reason I do not know its exact shape; only, upon the shoulders, these large conical tubercles may be seen to be a little curved above, and are of the same sort as those of which we have before spoken.

The head bore also on its superior part a shell of plates much smaller and irregular, but of the same construction as those of the shell. It is not in my power to describe it in detail, in consequence of that which we have in the Museum being broken. The same applies to the feet—without doubt well armed with plates like those of the living Armadillo, and having at the end of the toes large claws, of which there are four long ones on the anterior and five wide ones on the posterior extremities. There are a great quantity of small plates, very diverse in form and size, preserved in the Museum, which show by their construction that they were derived from the same skin. These plates probably belong to the feet and to some of the small joints, where the existing Armadillos have equally small plates, of partly formed shell.

The second species from the Buenos Ayres soil is *G. clavipes*, of which there exist in the Museum an imperfect shell and two tails. Undoubtedly it is larger than the first, although, as it is broken, we are not exactly aware of its dimensions; but the larger size of this animal is not alone demonstrated by the greater size of the loose plates of the shell, but by that of the bones of the skeleton which we have in the Museum. At the same time, it appears to me much more narrow and elongated than *G. spinicaudus*. The specific difference is very clear in the side plates of the shell,—the central hexagon being larger than the peripheral hexagons, and the structure of the surface being finer, less elevated, and less rough. The tubercles of the edge of the shell appear less convex, and the centre of the external superficies is a little elevated, as we have said above, compared with the tubercles of *G. spinicaudus*.

But the most distinguishable character of this species is the existence of a peculiar semicircular border below the tubercles of the edge, covered with rhomboid figures. This border does not exist in *Glyptodon spinicaudus*. The tail is very different, being long, thin, almost cylindrical, with some rings at its base

and a curved tube at its posterior portion. How many rings there were I do not know, as all the tails met with up to this time are broken; but it is very probable that the number of the rings of the tail were equal in all the species, that is to say, six. Each ring bears two or three bands of plates much finer than those of the shell, and of oblong form, each one presenting an elliptical scute in the centre and angular ones in the periphery. The figures here are almost smooth, and are deficient in the superficial rough structure of the shell. The posterior part of the tail forms an almost cylindrical tube a little curved, and thicker at the base than at the obtuse point. The surface of this tube has the same elliptical figures as the rings at the base, and between them a band of other, angular and much smaller figures. At the sides of this tube the ellipses change more or less into circles, and on the side itself is formed another band of much larger ellipses, which augment in size gradually to the point of the tail, the two immediately at the end being the largest.

The third species from Buenos Ayres is *G. tuberculatus*, which M. Nodot has erected into a separate genus—*Schistopleurum**. The different form of the plates on the surface of the shell above described easily distinguishes this group from the others. It is the largest of the three, and is double the size of *G. spinicaudus*. We only possess in the public Museum some pieces of the shell, and the posterior portion of the tail, of the general form of which we are consequently ignorant. M. Nodot states that at the edge of the shell there are some bands of moveable plates, and that for this reason he has separated this species from the others to form a particular group. There are in the Museum some plates of oblong form, with a large elliptical figure on the surface, and other smaller and irregular ones on the periphery. These plates form a kind of large ring, which is probably one of the moveable parts of the side of the shell. But it appears to me that it belongs to the posterior edge of the shell from which issues the tail, forming between the posterior cylindrical part of the tail and the shell some moveable rings, as in the other species. How many rings there were I do not know; but it is permissible to believe that there were six. The posterior portion of the tail of the animal which we have in the Museum is complete, and is 1 yard in length and 5 inches in breadth; its superficies is covered with the same small irregular figures as the shell; but between them we can see large ellipses as in the rings described. These ellipses are very different in pattern

* [Now well known in England by Mr. Gregory's excellent restoration. —Transl.]

and size, forming in the beginning of the tube two circles of eight small ellipses in each, and at the side three other bands of other and larger ellipses; the ellipses of the median band are much larger and more extended towards the point of the tail, where are to be seen two of a longitudinal diameter of 8 inches. But a large part of the tail of the same species in the Museum, recently discovered by me on the banks of the river Salado, is twice as long, which demonstrates that this animal was capable of attaining a truly gigantic size. The distinction between the three species is easy, as the foregoing description proves; but it is not easy to know whether the other species already described are well founded. Mr. Owen has further accepted two species, which he terms *G. ornatus* and *G. reticulatus.* Of the first he says that it is smaller than *G. clavipes*—a character which appears to indicate its identity with *G. spinicaudus*; but, without a knowledge of the shape of the tail of *G. ornatus,* it is not possible to know whether the two are really identical or different. Of *G. reticulatus* the author says that it is of the same size as *G. clavipes,* but different in its structure, which is reticulate on the surface of the shell-plates—a character which might apply to the plates of *G. tuberculatus* which are situated in the centre of the shell.

The three species of *Hoplophorus,* founded by Dr. Lund, I only know by the description of some parts which the author has given in the work already cited. They show a great similarity to the Glyptodons of Buenos Ayres; but, without an exact comparison of the objects themselves, it is impossible to know whether they are identical or different.

The accounts which I have read of the work of M. Nodot state that the author has established fourteen species, without specifying their differences; and for this reason we cannot arrive at any judgment whether they are well founded or not. It appears that we have accepted all the species already enumerated by different authors; but in this case the number of fourteen appears to be exaggerated, as can be proved by an examination of the three different species from Buenos Ayres.

Let us now pass to the examination of the skeleton.

For some time the feet, the tail, and the head of *Glyptodon* have been incompletely known. The same statement applies to the vertebral column and to the pelvis, recently described by Mr. Huxley, as the skeleton which was in his hands was very defective, which has consequently rendered his description very incomplete.

In the Museum of Buenos Ayres there is a nearly complete skeleton, known up to the present time by a photographic figure made by the able artist Señor Aldanondo (Calle Florida, 129),

and the more or less important remains of five more individuals, amongst which we have met with some specific differences from the two principal species from the soil of Buenos Ayres. Let us first describe the skeleton in general.

The skull is very thick, and, comparing it with the acute skulls of existing Armadillos, is very short and obtuse. The nasal bone, the forehead, and the vertex being in the same plane with the occiput, form a flat surface of 11 inches in length by 5½ in width between the eyes. This short figure depends principally on the shape of the nasal bone, which is so short that the point of the lower mandible by far surpasses that of the upper, which latter was in this animal much longer in the living state, as there then existed a broad and strong cartilage in this organ somewhat prominent from the head. It is probable that the living animal might have had a thick and strong snout, to grub up the earth, and seek its food in this manner, as the Armadillos do at present. It is not very evident up to what point the cranial bones extended, from the want of sutures of the skull, since it is entirely in one piece, and destitute of any suture, without any vestige of the primitive bones of the young animal. Neither can the frontal bones be distinguished from those of the vertex nor from those of the occiput, because they are all united in one capsule. The perpendicular part of the occiput is very low, and the foramen occipitale is of a transversely elliptical shape, which is not met with in any other mammal. The internal cavity of the cranium is of a surprising smallness, as was also the brain; and these characters indicate that this was an animal exceedingly stupid and sluggish—qualities which are also indicated by the size of the lower mandible and the great extent of its grinding-portion.

There is no other animal which has so descending a palate (*sic in orig.*) nor such projecting teeth as the *Glyptodon*. Above all, the ascending ramus of the inferior mandible is very high, in such a proportion that no animal equals it in this respect. The anterior inclination of this ramus, which forms with the horizontal ramus an angle smaller than a rectangle, is a character peculiar to the *Glyptodon*; and this inclination indicates a powerful grinding-apparatus, which surpasses that of other Mammalia, even that of the Elephant. The symphysis is produced, like the spout of a jug (*la boca de un cántaro*), this part being toothless; there are eight teeth on each side of the inferior and superior mandibles, more or less alike in form; but those of the upper mandible are a little larger, and those of the fore part of each jaw slightly narrower.

Each tooth is formed by the conjunction of three rhombic prisms, which have on each side deep excavations between the prominent points of the three prisms. This form may be com-

pared with that of the teeth of the Carpincho: it is peculiar to the *Glyptodon*, because no other animal equally large possesses teeth of this form. The zygomatic arch of this animal, besides being thick, was provided with a perpendicular prolongation which descended from underneath the eye, giving us a proof that it ground hard substances. This prolongation is only discovered in antediluvian animals, such as the *Megatherium*, *Mylodon*, or the *Scelidotherium* *.

As we only intend to describe the principal parts, I shall here conclude the cranium, and shall give a description of the differences in the teeth of the various species of the animal, they being the only parts which can be compared one with another.

I have in my possession portions of three lower mandibles, two of which belong to *G. clavipes*, and the other (which is complete) to *G. spinicaudus*. The general form and the relations of the teeth are the same; but the form of the prisms in each tooth is a very little different. The sides of each rhombic prism of *G. clavipes* are a little curved into the interior of the prism; but those of *G. spinicaudus* have a slight external elevation; and for this reason the dental prisms in the former species appear to be thinner and more acute at the corners, and those of the second thicker and more obtuse. In the work of Dr. Lund (second part, tab. 35. f. 2, 3 & 4) there are figures of two teeth which appear to exhibit a slight difference, as regards the form of the prisms, from those of my two species, demonstrating that there was a slight difference between the Brazilian species and those of Buenos Ayres. These teeth are from the upper jaw,—fig. 2 being the first, and fig. 3 the last tooth on the left side.

The neck of the *Glyptodon* comprises seven vertebræ, as in other Mammalia; but only the first and the last are moveable, the other five being united into one solid mass; hence it results that the neck is very short and powerful. The first, or atlas, is of considerable size, and of the form occurring in other Mammalia; its two wings are laterally compressed, ascend posteriorly, and have three smooth and even slightly concave excavations for their articulation with the second vertebra. This (the axis) is short and united with the four following ones in one piece, which developes in front a small tuberosity for its articulation with the atlas. At each side of this bone there is a strong prolongation inclined backwards, and before it four foramina for the transmission of nerves, which indicate the five united vertebræ. There is another prolongation on the top of the arch above the vertebral column, which is also inclined backwards, and is terminated by three points. This particular bone is already known

* [It is also visible in the existing Sloth.—TRANSL.]

by a description and a drawing in the second part of the work of Dr. Lund (tab. 35. fig. 1).

The seventh vertebra is moveable and free, but maintains almost the same form as one of the four which are united with the axis. It is a very small bone, transversely elongated, with a large, almost triquetral perforation in the centre, and three processes—the upper one short, and the other two strong ones at the sides. The lower portion, which in other Mammalia constitutes the rather thick body of the vertebra, is a very delicate plane, of scarcely any thickness in the centre, and half an inch in breadth.

The vertebral column, or spine, appears to me to be the most remarkable part of the animal, it being a solid arched canal, without division into separate vertebræ in conformity with the rule in other mammals. This vertebral canal is bent, as the form of the animal requires, and is armed in its superior part with three crests, of which the middle corresponds to the spinous process [neural spine, Owen], and those of the sides to the transverse processes [or rather to the metapophyses, Owen] of each vertebra in other Mammalia. But of the body [centrum] of the vertebra, which in Mammalia is generally very thick, nothing is seen; and the lower part of the canal, which corresponds to the bodies of the vertebræ, is most fine and thin in all its circumference. The canal alters in shape a little: towards the fore part it is wide and low; and towards the back, little by little, narrower, but higher, and in this way the three crests meet. The whole of the vertebral canal is divided into three parts, of which the two anterior correspond to the dorsal vertebræ, and the third to the lumbar vertebræ.

The first part of the canal is the smallest; beneath, in the lower part, it is about $2\frac{1}{2}$ inches long, and 4 inches above. Its width in the middle is about 7 inches. It is composed of three united vertebræ—the first small, nearly of the same size as the last cervical vertebra, and the other two larger, demonstrated by the holes in the sides, from which issue the nerves of the myelon. The upper surface is smooth, and exhibits a high and thick backward prolongation, which rises considerably at the sides of the bone. Here we see two other prolongations, which correspond to the transverse processes of the three vertebræ: the first is very strong, prolonged in an antero-posterior direction backwards, and corresponds to the first two vertebræ; the second is very short and thin, but also broad. On these processes we see the articulations of the first three ribs—the first in the anterior part of the first prolongation, the second in the posterior part, and the third in the exterior part of the second prolongation. This first, trivertebral part is

joined with the following bone of the vertebral canal by means of a very moveable articulation, so as to raise itself and retract itself on the neck. In the same manner the head moves itself by the operation of this trivertebral bone enabling it to enter more or less into the interior cavity of the shell, and to protect itself in this retired position from the attacks of other animals, in the same manner as the existing Armadillo. If it were not for the presence of this bone, the head of the animal could not move itself out of the shell, or, at will, retract itself within.

Mr. Huxley, who very well describes this bone as a piece composed of three vertebræ, supposes that the great mobility of this bone was necessary for the respiratory motion of the thorax, the ribs not being sufficiently moveable at their articulation with the vertebral tube. I cannot participate in this opinion; on the contrary, the true function of this trivertebral bone is to facilitate the motion of the head both forwards and backwards, as I have already explained. There is no difficulty in the motion of the ribs on their articulations, notwithstanding that there is a remarkable difference between their conformation and that of other Mammalia, as is proved by the form of the articular excavations at the side of the vertebral canal.

The second part of the spinal canal is the longest; it is 17 inches in length in its curvature, and about $3\frac{1}{2}$ inches in breadth forwards, gradually diminishing to 2 inches. The anterior part is smooth, with the first and inferior of the three crests ascending gradually higher on the upper side, having ten round foramina on each side of the canal, for the transmission of the nerves of the myelon, which proves that this part of the canal was composed of eleven united vertebræ; but there is no vestige of external separation on the surface. Besides, we see on each side, outside the lateral crests, eleven articular impressions of a peculiar form, like a ∞, for the ribs which unite by them with the spinal canal.

The third part of the spinal canal unites with the end of the second part, not by an articulation, but by a cartilaginous and moveable juncture, which anatomists term *synchondrosis*. It is by this that the edges of the canals which are in contact slightly extend towards the sides. The part of the vertebral column which follows is also different in form, being a little broader, and, on the dorsal surface only, armed with a very high median crest, but without transverse processes on either side, in consequence of the absence of the ribs.

But there is in the beginning of the canal, and on each side of this high dorsal crest, a process which projects forwards, and is in contact with the end of each lateral crest of the second part. In this process there is also the half of the articular excavation

which receives the ribs. But below the lumbar canal, there are on each side some rather large foramina for the nerves which issue from this part of the myelon. I have counted in the two lumbar canals which are in the Museum, belonging to *Glyptodon clavipes*, six of these foramina, and in the same canal of the *G. spinicaudus* seven, which proves that the number of vertebræ united in this canal are six in the first species and seven in the second. There are probably corresponding differences in the anterior part of the vertebral canal of the two species, that of the *G. clavipes* being much larger and consequently more numerous in the vertebræ. The last part of the lumbar canal immediately unites with the sacrum without any articulation; the two appear to be the same bone.

The os sacrum is formed of nine vertebræ united in one solid mass, which is broad and thick at the commencement, thin, long, and high in the centre, and thick with two long prolongations, one on each side, at the end. The first part is composed of three rather short vertebræ, which unite forward with the pelvis, and constitute with it a very high crest, on which the shell of the animal is supported. The second part is composed of five rather long vertebræ, and is in the figure of a curved tube, with a high crest on its upper part. Five foramina on each side of the tube, for the nerves of the myelon, indicate the number of vertebræ in this part of the sacral bone. At the end, it extends at its base into a solid and thick mass, which assumes the form of the body of a vertebra, and is actually the last vertebra of the sacral bone. On each side of it a horizontal prolongation extends, smooth and broad, which corresponds to the transverse process of the vertebra, and by this prolongation the os sacrum unites for the second time with the pelvis. Another small prolongation of the penultimate vertebra also unites with this horizontal branch. The sacral bone of the Armadillos is formed in the same manner, especially that of the Mataco.

The pelvis is the largest part of the skeleton, and is of a very peculiar form. Its thickness is caused by the fact that the whole weight of the shell of the animal is superimposed on it, as it is the only bone which unites immediately with the shell. For this reason the pelvis extends forward and backward into two great perpendicular alæ which gradually augment into very broad and strong crests, armed with many obtuse tuberosities, which impinge upon other similar ones on the inferior surface of the shell, having between them large cushions of an elastic cartilaginous substance, to sustain the weight of the shell more easily, and to permit its more facile elevation during the movement of the body. The anterior prolongations are placed across the spine, and belong to that part of the pelvis known by the name of the

iliac bone; those of the back part are placed longitudinally, and parallel to the median crest of the os sacrum, belonging to the ischial bone of the pelvis, and rising towards the place to which are joined the lateral prolongations of the last sacral vertebra. The two posterior alæ are distant from each other, but the anterior ones unite in the centre of the animal, and, with the high crest of the first three vertebræ of the os sacrum, form a cross below the centre of the posterior and heaviest part of the shell. The iliac bone descending from this spot inclines a little inferiorly, forming at its lower end the articulation for the thigh termed the acetabulum, into which enters the hemispherical head of the femur. The direction of that part of the principal posterior ramus of the pelvis, termed the ischium, runs almost horizontally towards the place of the posterior ascending ala, which is a subcylindrical and very thick bone, extending inferiorly into a long perpendicular and slightly inclined plate. The os pubis, on the contrary, is very slender, similar to a small rod, which extends a little at the lower end, unites with the ischium, and forms a symphysis pubis, which until now was not known in the *Glyptodon,* as it is absent in all the pelves discovered. For this reason, we must calculate that it was very slender and delicate, being perhaps a little open in the centre, and merely united by cartilaginous substance, which is also the case with the Peludos and with the Matacos of the present day.

We perceive behind the pelvis the vertebral column of the tail, which is rather strong and composed of loose vertebræ of different number in different species. Each vertebra possesses a thick cylindrical part below, and a vertebral arch above, from which issue three perpendicular prolongations anteriorly and one horizontal one, with two obtuse points posteriorly. Of these the central one is the spinous process, and the other four the oblique processes. There issues from each side of the body of the vertebra, and between these processes, a transverse process with an elevation at its extremity. All these parts gradually diminish in a posterior direction, the last vertebra being a conical body without any arch or process on its surface. Generally the three vertebræ at the base of the tail are not only the largest, but also differ by their more extended transverse processes; in the following ones this process is shorter, and at the end more reclinate, because it is these vertebræ which are connected with the caudal rings, and the three basal ones are not.

I am only able to state with exactitude the number of the caudal vertebræ of *G. spinicaudus*; they are ten, of which six are met with in the caudal rings. According to the specimens exhibited in the Museum, we can calculate with exactitude that

G. clavipes had at least thirteen or fifteen and *G. tuberculatus* seventeen or eighteen of these vertebræ.

The ribs of the *Glyptodon* are very slender, and broader than thick. Each one has a rather long head, with an articular surface on the two sides, adapted to the two articulations, which are almost united, like a ∞, in the excavations of the external side of the lateral processes of the spinal canal. Immediately behind the head they are delicate, then gradually expand and assume a cylindrical form. They unite with the sternum by the medium of strong sternocostal bones, of which there are five pairs, and some loose ones; but, as the sternum is wanting, I cannot exactly describe this part of the skeleton. Probably it was very delicate, and has been broken in consequence. Neither have I seen, up to this day, the clavicle of this animal, which it ought to have, as is demonstrated by the analogy of the existing Armadillos.

The general number of ribs of the *G. spinicaudus* is fourteen pairs, of which three pairs unite with the first, trivertebral bone of the vertebral canal, and eleven pairs with the second bone.

The form of the scapula is very peculiar, as it is a very slender and long plate of a rhomboidal form, rather short and round in the anterior portion, but very long and acute posteriorly. There arises from the external surface, a little before the centrum, a crest, low at the commencement, which descends down to the articular cavity for the arm, to which it prolongs itself in a very strong, flattened, and curved process, like a pothook, which is the acromion. Behind this is found the rather narrow articulatory cavity for the arm, a little concave and elongate, and with a short protuberance on the fore part of its inner side, which is termed the coracoid process.

The bones of the arm and of the leg are very robust, especially those of the latter. The humerus has the form of a *mashorca*, a little curved inferiorly, and the two bones of the forearm are united in such a manner that the pronation and supination of the hand is impossible; the hand appears to have possessed little power of rotation. The carpus comprises seven small bones, but wants the os unciforme of the hand of Man. The form of the os pisiforme is very peculiar, as it is a long and broad bone, of the form of a small tongue, united articularly with the ulna. The largest bones of the interior of the hand are the metacarpals, with the exception of the thumb, which is small, and is prolonged downwards into a small round head. The thumb is destitute of phalanges, excepting one small ungual phalanx, which is connected with the metacarpal. The other three toes have two very short phalanges on each, and a very large ungual bone.

MM. D'Alton and Huxley have described the hand of *Glyptodon* as possessing five digits, the first taking the fourth toe for the

fifth, and the second placing the thumb in the place of the fifth toe, calculating that the animal most resembled *Dasypus*, which has five toes on the hand, and not *Praopus*, which possesses only four. But the construction of the armour, especially of its horny covering, demonstrates that the *Glyptodon* was more similar in its construction to *Praopus* than to *Dasypus*.

The leg is very strong: undoubtedly the femur is the strongest of all the bones of the skeleton. At its head there is no cavity for the ligamentum teres, and from the outer side of the head arises a very prominent trochanter major. We also see a corresponding prolongation on the outer side of the external inferior condyle.

The tibia and the fibula are united into one bone largely perforated in the middle; and the foot is very thick, high, and short, with a calcaneum rather prominent posteriorly, which proves that the animal was plantigrade, like the Armadillos. The bones of the tarsus are complete; but those of the fore part are very short, like the metacarpals of the five toes. These have the general configuration of those in unguiculated animals, as the ungual bones are very broad and strong.

We shall finally conclude this description with the notice of the fact that in the hand as well as in the foot there are peculiar bones, which are the sesamoid bones. There are three similar bones in the hand for the three toes next the thumb, which are developed below the phalanges beyond the ungual bone. But in the foot there are ten sesamoid bones, one in each toe, excepting the "hallux," and below the second anterior ungual phalanx, and two on the inferior part of the metatarsal bones of the three median digits. These last have a very peculiar form, as they are divaricated, to permit the principal digital tendons to pass through them. There is another bone of a very peculiar form in the centre of the hand, to which the tendons of the toes are attached. A similar bone also exists in some existing Armadillos, and is described by Cuvier in his work 'Recherches sur les Ossemens Fossiles,' tom. v. p. 128, tab. 2. figs 12 & 13.

X.—*On the* Menispermaceæ.
By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 53.]

12. Odontocarya.

This is the only South-American form, as *Calycocarpum* is the sole North-American genus, of the *Heterocliniеæ* hitherto known, all the other eleven genera of this tribe belonging to Asia or Africa. The plant on which this genus was established was found by me in the Organ Mountains as far back as 1828, and

again in 1837, but only in fruit; this enabled me to ascertain its peculiar carpological structure—an investigation that afterwards led me into an examination of the whole family. In 1845 my son sent me, from nearly the same locality, an imperfect specimen of another plant, which, from the similar form of its leaves and petioles and the structure of its flowers, appeared like a male species, and accordingly, in my "Notes on Menispermaceæ," in 1851, I alluded to it under this belief; for its floral parts, though in quinary numbers, presented the usual biserial arrangement of alternate sepals and ten stamens, the outer five being quite free, with the same number of fleshy scale-like petals at their base, while the five internal stamens were monadelphous for half their length. This so far appeared to correspond with *Coscinium, Chasmanthera,* and *Pselium,* except in the number of its parts; but, as I had met with the number five in other genera, the whole structure seemed conformable with *Menispermaceæ.* It is true that I found an occasional flower which, with a similar arrangement, presented the addition of a single 1-celled, 1-ovular ovary in the centre; but I had observed a similar occurrence in *Anomospermum* and *Tiliacora.* A more careful examination of the stem of the plant afterwards convinced me that it was not Menispermaceous, but a species of *Jatropha,* with occasional hermaphrodite flowers. The fact is worth recording, as it offers another coincidence in the resemblance of the male flowers of some *Euphorbiaceæ* to those of *Menispermaceæ,* as St. Hilaire long before pointed out in the case of some species of *Phyllanthus.* The authors of the 'Flora Indica' (p. 171) have made some valuable observations, showing several points of resemblance in the floral structure of these two families; and the case above cited affords a strong proof of the truth of their remarks. The authors of the new 'Genera Plantarum,' in excluding *Odontocarya* from the order, and referring it to *Euphorbiaceæ,* probably had the circumstance above mentioned in their recollection; but they forgot at the same time that the genus maintains its ground upon the unquestionable organization of its seed, upon the habit of the plant, and upon the structure of its wood. The chief peculiarity of the genus consists in its putamen, which has a scutiform condyle as in *Calycocarpum, Aspidocarya, Jateorhiza, Parabæna,* and *Rhigiocarya,* and it is covered with a matted, short, papillose coating, imbedded in the fleshy pulp of its mesocarp, as in *Jateorhiza, Burasaia,* and *Hæmatocarpus.* Most of the species resemble *Tinospora* in their habit and in their cordate, glabrous, membranaceous leaves upon long petioles; the inflorescence is in slender racemes, longer than the petiole; the fructiferous racemes are somewhat longer, and, in the typical

species, bear drupes of the size and colour of grapes, enclosing an osseous putamen, with three teeth at each extremity (whence the generic name); in the structure of its seed it corresponds with the rest of the *Heteroclineæ*. Belonging to this genus, there is a group of plants which I formerly referred to *Chondodendron*, R. & P. (Ann. Nat. Hist. ser. 2. vii. 44), in consequence of their resemblance to Pöppig's drawing of his *Chondodendron convolvulaceum*; but when I met with the typical species of that genus, collected by Pavon, I saw at once the error. Subsequently I was able to identify the group alluded to with *Odontocarya*, from specimens in flower and fruit from Panama: these are all more slender plants, with smaller leaves than in my typical species; but they all possess the same habit and a similar floral and seminal structure.

Odontocarya, nob.—*Flores* dioici. *Masc. Sepala* 9, quorum 3 exteriora dimidio minora, angustiora, et bracteiformia, 6 interiora majora, 2-serialia, æqualia, cuneato-oblonga, tenuiter membranacea, nervosa, æstivatione valde imbricata. *Petala* 6, subæqualia, sepalis opposita et iis paulo minora, ovata, tenuiter membranacea. *Stamina* 6, petalis opposita, iis æquilonga, imo in columnam brevem coalita, superne libera; *filamenta* latiuscula, complanata, tenuiter membranacea, apice rotundata, antheras sæpe excedentia; *antheræ* 2-lobæ, lobis oblongis, parallele sejunctis, filamento immersis, rima marginali dehiscentibus. *Ovaria* rudimentaria nulla.—*Fœm. Sepala* et *petala* ut in masc. *Stamina sterilia* 6, forma marium, sed multo minora, antheris effœtis glandulæformibus terminata, circa gynæcium stipitatum inserta. *Ovaria* 3, oblonga, extus gibbosa, apice tenuiora, glabra; *stylus* nullus; *stigma* sessile, deltoideo-acutum, subito deflexum, radiato-incisum; *ovulum* unicum, ex angulo ventrali appensum. *Drupæ* ovatæ, 3, vel abortu solitariæ, mucilagineo-carnosæ: *putamen* osseum, ovatum, subcompressum, dorso convexum, tuberculis serialibus scabridis rugulosum, apice imoque 3-dentatum, extus pilis papillosis creberrimis tectum, 1-loculare, intus læve, nisi ad ventrem lineis paucis transversalibus prominentibus notatum; *condylus* ad faciem ventralem, scutiformis, extus concavus, intra loculum convexus. *Semen* loculo conforme, meniscoideum, e summo condyli funiculo brevissimo appensum; *integumenta* tenuissima, facie ventrali *raphe* longitudinali signata: *embryo* fere rectus, intra albumen copiosum carnosum fere 2-lamellosum latere dorsali tenue, ventrali crassum, fissuris paucis transversalibus ruminatum, *radicula* supera, tereti, ad stylum spectante, *cotyledonibus* ellipticis, membranaceo-foliosis, 5-nerviis, lateraliter valde divaricatis, et in locellis sejunctis utrinque positis.

Frutices *scandentes,* ramis *lignosis, verrucosis,* cortice *tenui, resiliente,* ramulis *teneribus, subfistulosis;* folia *alterna, longe petiolata, sæpius palata, ovata, cordata, acuminata, submembranacea, glabra aut subpubescentia,* 5–7-*nervia;* racemi *graciles, axillares,* pedicellis *subfasciculatis,* 1-*floris;* drupæ *pulposæ, uviformes.*

The following species will be described in the 'Contributions to Botany,' vol. iii. :—

1. *Odontocarya acuparata,* nob. ;—mont. Organenses.
2. —— *macrostachya,* nob. ;—Cissampelos vitis, *Vell. Fl. Flum.* x. tab. 137 ;—Brasilia.
3. —— *convolvulacea,* nob. ;—Chondodendron convolvulaceum, *Pöpp. N. Gen.* ii. tab. 190 ;—Chondodendron tomentosum, *Benth.* (*non R. & P.*) ;—Peruvia.
4. —— *tamoides,* nob. ; — Cocculus tamoides, *DC.* ; — Rio Janeiro.
5. —— *sagittata,* nob. ;—Demerara.
6. —— *hederæfolia,* nob. ;—Chondodendron hederæfolium, *nob. olim* ;—Chondodendron tomentosum, *Benth.* (*non R. & P.*) ; —Brasilia, Guiana, et Panama.
7. —— *scabra,* nob. ;—Chondodendron scabrum, *nob. olim* ;—Chondodendron tomentosum, *Benth.* (*non R. & P.*) ;—prov. Piauhy (Gardn. 2473).

13. Rhigiocarya.

Among the plants collected in the Niger Expedition by Mr. Barter is one that presents much the habit of a *Chasmanthera* : the structure of its putamen is sufficiently remarkable to make it the type of a new genus. The plant has a climbing Cissoid habit, with large, cordate, oblong, membranaceous leaves, supported on a rather lengthened petiole. It has an axillary simple fructiferous raceme, longer than its elongated petiole, with a somewhat flexuose rachis, having alternate fructiferous pedicels; the drupes are oval, slightly gibbous, fleshy, about $\frac{3}{4}$ inch long, containing an oval and somewhat compressed putamen, covered along its sides and over its dorsal face with crowded, erect, stoutish spines, truncated at their apex, and terminated by a short tuft of fibrous hairs; the ventral face is smooth, formed by a large convex raised condyle, of an oval shape, with a long linear foramen down the middle, opening into a large hollow chamber which protrudes far into the cell. The seed is oval, meniscoid, slightly hollow on its ventral side, showing a longitudinal raphe the length of the delicate integument which covers a simple albumen; the embryo, of the shape usual in the *Heterocliniеæ,* has its cotyledons imbedded in distinct cavities in the

albumen. The whole plant is glabrous, but neither its male nor female flowers are known. In many of its characters it approaches *Aspidocarya, Parabæna, Odontocarya,* and *Jateorhiza,* but differs from all of them in having a very large 1-locellate chamber in the condyle of its putamen. Its name is derived from *ῥίγιον, horrificus, καρύα, nux,* in allusion to its hystricoid putamen.

RHIGIOCARYA, gen. nov.—Flores ♂ et ♀ ignoti. *Drupa* ovöidea, pulposa, uviformis; *putamen* ovoideum, compressum, osseo-testaceum, 1-loculare, crista lamelliformi apiculata lateribus et dorso undique crebriter echinata, spinis rectis apice truncatis, singulis fascicula pilorum terminatis; *condylus* faciem ventralem fere totam occupans, scutiformis, prominens, subconvexus, lævis, extus meatu lineari longulo perforatus, ample 1-cameratus, et intra loculum seminis valde intrusus: *semen* loculo conforme, meniscoideo-ovatum, facie ventrali concavum, extus convexum; *integumenta* tenuissima, *raphe* ventrali longitudinali notata; *embryo* paulo convexus, intra *albumen* carnosum simplex inclusus, *cotyledonibus* tenuiter foliaceis, lateraliter valde divaricatis, in locellis albuminis sejunctim positis, *radicula* tereti brevi supera ad stylum spectante ter longioribus. Suffrutex *scandens Africæ tropicæ occidentalis, glaberrimus*; folia *magna, late oblonga, valde cordata, 5-nervia, submembranacea,* petiolo *elongato;* racemi *fructiferi supra-axillares, solitarii, glaberrimi, petiolo longiores,* pedicellis *simplicibus;* drupæ *uviformes, pulposæ.*

The typical species will be described in the 'Contributions to Botany,' vol. iii.:—

1. *Rhigiocarya racemifera,* nob.;—fluv. Quorra.

14. ANOMOSPERMUM.

The type of this genus is a scandent shrub which I found in the Organ Mountains in 1837; other species exist in Guiana and Northern Brazil. They have all oblong, stiff, glabrous, subcoriaceous leaves, sometimes reticulated, with rigid petioles articulated on the branch in a prominent cup. The inflorescence is in axillary racemes issuing from a hairy tuft a little above the petiole. The male raceme, in some species, is the length of, or longer than the leaf, its alternate branches bearing one to three flowers, or sometimes the inflorescence is reduced to a solitary pedicellated flower in each axil. The female raceme is much shorter and few-flowered. The flowers are of similar size in both sexes, measuring, when expanded, 2 or 3 lines in diameter: they consist of six fleshy sepals, alternate in two series, the outer three being much smaller and bracteiform; they have

six petals, also 2-serial, smaller than the inner sepals, rounded, extremely fleshy, the edges folded inwards so as to embrace and almost conceal a stamen fixed on its claw; each filament bears two small anther-cells half imbedded in its substance. A single sterile ovary is sometimes seen in the centre of the male flower, being columnar, somewhat ventricose, and terminated by a fungiform stigma: this I found of usual occurrence in the typical species, but I have not met with it in the few flowers examined of other species. In the female flowers, the petals are divaricated, less fleshy; and the six sterile shorter stamens stand erect and free round three gibbous ovaria, supported on a short gynæcium. In the typical species, the fruit is gibbously oval and somewhat compressed, about an inch long, having its stipitate enlargement near the middle of the ventral side, at some distance from the persistent stigma: it is covered by a coriaceous indehiscent husk, of a yellowish colour, that becomes dark in drying; between this and the putamen is a yellowish mesocarp, having the consistence of an arillus, and apparently formed of rounded masses aggregated together, corresponding in size to the large areoles indicated by the grooved lines on the surface of the putamen: it dries into a horny substance insoluble in water or alcohol. In the Guiana species, the fruit is cylindrically oblong, with a laterally basal support, and with the remains of the stigma in its apex, the putamen being quite cylindrical, and the embryo straight. The peculiar structure of the putamen and seed has been already noticed in the diagnosis of the tribe *Anomospermeæ*: one of its chief peculiarities consists in the form of its condyle, which is a laminiform and longitudinal osseous plate, projecting from the ventral face of the putamen to near the centre of the cell, and upon which the seed is folded and attached; several other short transverse plates project across the dorsal face of the cell, which penetrate into the sinuosities of the albumen, after the manner of many *Anonaceæ*; these, however, are only adventitious processes. The lamellarly ruminated structure of the albumen much resembles that of *Tiliacora*, and the embryo, either straight or uncinately curved, is equally elongated and slender; but the radicle is relatively much shorter, and the cotyledons are accumbent in the one, and incumbent in the other.

Mr. Bentham, in his 'Notes on *Menispermaceæ*,' in accordance with the system he has so extensively adopted, considers all the plants of this genus reducible to a single species. It is impossible to concur in this opinion, which is absolutely incompatible with the facts here registered.

Anomospermum, nob. — Flores dioici vel rarius polygami.

Masc. Sepala 6, biseriata, quorum 3 exteriora minuta, bracteiformia, 3 interiora multoties majora, alterna, orbiculata vel oblonga, concava, carnosa, petaloidea, glabra, æstivatione imbricata. *Petala* 6, æqualia, sub-2-seriata, sepalis paulo breviora, suberecta, vel arcte congregata, interdum unguiculata, gibbosa, concava, carnosa, apice truncata, marginibus valde inflexis, hinc stamina amplectentia. *Stamina* 6, petalis æquilonga et opposita, cum iis inserta; *filamenta* sigmoidea, carnosa, subcompressa, apice incrassata; *antheræ* 2-lobæ, introrsæ, imo divaricatæ, semiimmersæ, utrinque rima laterali dehiscentes.—*Fl. hermaphr. Sepala, petala* et *stamina* marium: *ovarium* unicum, sterile, centrale, cylindricum, *stigmate* clavato coronatum. — *Fl. fœm. Sepala* et *petala* marium. *Stamina* 6, breviora, antheris minutis, effœtis. *Ovaria* 3, libera, obovata, gibba, supra gynæcium pilosum insita, sepalis interioribus opposita, 1-locularia, *ovulo* unico parieti ventrali affixo. *Stylus* brevissimus, excentricus, crassiusculus. *Stigma* ligulatum, acutum, canaliculato-recurvum. *Drupæ* 3, vel abortu 1, majusculæ, oblongæ, vel gibboso-ovatæ, plus minusve excentrice stipitatæ; *pericarpium* nitens, crassum, coloratum, styli vestigio apice vel longe a basi notatum, indehiscens; *mesocarpium* mucilaginoso-pulposum, translucidum, e glandulis plurimis angulatis, arcte cohærentibus confectum; *putamen* cylindrico-oblongum, vel reniformi-ovatum, subosseum: *condylus* internus, ad faciem ventralem, laminiformis, longitudinalis, fere ad centrum loculi protensus, hinc semiseptum mentiens. *Semen* loculo conforme condylo utrinque plicatum: *albumen* copiosum, loculum implens, carnosum, in fissuris numerosissimis undique profunde ruminatum, *integumentis* 2 tenuibus fissuras penetrantibus arcte cinctum; *embryo* elongatus, tenuissimus, teres, fere rectus, vel imo arcuatus, in centro albuminis situs, *cotyledonibus* tenuibus, *radiculæ* brevi tereti ad hilum spectanti æquilatis et multoties longioribus.

Frutices *scandentes, Brasilienses et Guianenses, glabræ*; folia *alterna, elliptica, subcoriacea,* 3-*nervia, valde reticulata, petiolata;* racemi *supra-axillares.*

The following species will be described in the 'Contributions to Botany:'—

1. *Anomospermum nitidum*, nob.;—mont. Organens.
2. —— *ovatum*, nob.;—Brasilia.
3. —— *oblongatum*, nob.;—Rio Janeiro.
4. —— *Schomburgkii*, nob.;—Guiana Brit. (Schomb. 833).
5. —— *lucidum*, nob.;—Cayenne (Melinon, 115); Demerara (Anderson); Panurè Rio Uapès (Spruce, 2563).
6. *Hostmanni*, nob.;—Surinam (Hostmann & Käppler, 1298).

[To be continued.]

XI.—*On the Metamorphoses of the Prawns.* (First Memoir.) By Dr. Fritz Müller of Desterro*.

[Plate IV.]

Milne-Edwards indicated, as probably the larva of *Peneus*, a small Crustacean which had previously been referred to the Schizopoda as forming the genus *Cryptopus* of Latreille. I observed several species of small Crustacea approaching still more closely to the Schizopoda, and agreeing with *Cryptopus* and *Peneus* in the possession of three pairs of cheliform feet, and have been able to trace them back to *Mysis*-forms destitute of chelæ, thence to the form of a *Zoëa*, and one species still further to a *Nauplius*-form, and consequently to that fundamental young form which unites the Rhizocephala and Lernææ with the Cirripedes and the numerous group of the Cyclopidæ.

Of the *Zoëa*-form five different species were observed, and some of them pretty plentifully during the whole summer; the unaltered *Nauplius*-form, probably the same in which the animal escapes from the egg, came under notice only once (on the 13th December) †.

The body of this youngest larva (Pl. IV. fig. 1) is destitute of segments, pyriform, 0·4 mill. in length, rounded, and 0·2 mill. in breadth in front, and diminished behind to $\frac{1}{5}$th of the length of the body, truncated, and slightly emarginated. Near the anterior margin stands a small, black, sharply defined eye. The posterior margin bears on each side a strong straight bristle, of half the length of the body, and near this a short spine. From the lower surface of the body spring six slender feet, furnished with long setæ, of which the anterior and intermediate attain four-fifths and the posterior about half the length of the body. The anterior are placed close to the frontal margin, the intermediate pair immediately behind these, and the posterior about the middle of the body. The anterior are simple, the intermediate and posterior biramose; the posterior branch appears to be the immediate continuation of the stem, and is stronger and, in the hinder feet, also much longer than the anterior branch. No distinct joints are to be detected in the feet, but indications of four or five joints may be seen in the posterior branch of the intermediate feet. A strong bristle, as long as the body, stands with some shorter ones at the apex of the anterior feet; the inter-

* Translated by W. S. Dallas, F.L.S., from Wiegmann's 'Archiv,' 1863, p. 8.

† This proves that, at least at the breeding-season, the parents do not reside in the vicinity of the shore, as otherwise the youngest larvæ must have been the most abundant. A species nearly allied to *Peneus Caramote*, which is frequently eaten here under the name of *Camarao* occurs sparingly in the market in summer, and scarcely ever above the middle size.

mediate feet have two bristles at the apex of the anterior branch, and six on the anterior margin and apex of the posterior branch; and each branch of the posterior feet has two bristles at its apex and one below this point.

The little animal is rather opaque, and of a brownish colour, which is more strongly marked at the apices of the feet. The structure of the mouth and of the internal organs was not observed.

The somewhat flexible feet, with their few long bristles, form no very effective motory apparatus. A man floating perpendicularly in the water, with widespread arms and slender willow-branches in each hand, striving to work himself upward, would furnish a notion of the peculiar movement by which this *Nauplius* and the *Zoëa* proceeding from it may be recognized at the first glance amongst hundreds of other small Crustacea*.

In a rather larger larva (0·5 mill. in length), taken on the 13th of January, which agreed in the general form of the body, in the structure of the feet, and in colour with the preceding one, the posterior extremity was drawn out into two thick conical processes, at the apices of which stood the two long caudal bristles, each accompanied on the inside by two and on the outside by three shorter and partly spiniform bristles. The number of bristles on the intermediate feet had also increased. As the first indication of the carapace, a transverse fold ran across the back, nearly in the middle of the body. The posterior feet were placed more anteriorly and nearer the median line, towards the mouth, which is situated between them; before the mouth, between the intermediate feet, was a large helmet-shaped upper lip. The short stem of these feet had become thickened almost into a globular form; some new part was evidently being formed in its interior, the outlines of which, however, were not yet distinct. Behind the mouth, and filling the median third of the body, four pairs of long and plump lobes had sprouted from the ventral surface, and, inclining backwards, had applied themselves to the body. In the form of the first two pairs the future lower jaws could already be recognized.

This larva is closely approached by four others, probably belonging to the same swarm, which were taken at the same time (24th of January). In the swelling at the base of the posterior

* From this peculiar movement, observed with the naked eye, I recognized the little animal just described as the larva of *Peneus*; microscopic examination made this opinion appear, if not erroneous, at least extremely improbable. A month later, intermediate forms occurred which showed the naked eye to have been right, in opposition to the microscope; the latter alone would probably never have led me to suspect the true nature of my *Nauplius*.

feet (fig. 2), the outlines of the future upper jaw may be distinctly recognized; the living contents are more or less completely withdrawn from the posterior ramus; the anterior ramus is still pretty well filled, but we may already see that it will be destitute of bristles after the change of skin. Of these feet, therefore, besides the stem which becomes converted into the upper jaw, only a short bristleless stump will remain. (An organ of this kind, rendered very striking by its dark brownish colour, was in fact observed once [on the 3rd of January] in a very young *Zoëa*; but even this soon disappears completely). Between the origins of the anterior feet two ganglia of considerable size, contiguous in the median line, may now be distinguished. In the anterior angle between these two ganglia the eye is situated, surrounded by numerous small orange-coloured globules (oil-drops?). Over the eye, and concealing it from above, a turbid finely granular tissue has been formed; from each side of this springs a small transparent button, projecting in a hemispherical form beyond the frontal margin. The intestine, liver, and heart are already present, of the same form as in the younger *Zoëæ*.

It is probable, as shown by their bristles being already indicated, that at the next moulting the rudimentary feet become effective, and the *Nauplius* becomes converted into a *Zoëa*, to the appendages of which the names in use for those of the mature animal may be applied with less wresting of their meaning. I therefore henceforward indicate the first two pairs of feet of the *Nauplius* as antennæ, and the third as upper jaws; and of the four new pairs the two anterior as lower jaws, and the hinder as footjaws.

In the *Zoëa*-form (figs. 3–7) our larva was observed from 0·8 to 1·6 mill. in length. During this life-period the two eyes are developed, ten or eleven new segments are formed, with a pair of feet on the first, and rudiments of feet on the five following rings, and, lastly, the lateral caudal appendages are produced. These new parts are of course met with in very variable form; in other respects the animals undergo no important changes, even in size; for their increase in length proceeds almost exclusively from the gradual extension of the eleven new segments.

The carapace, 0·4 to 0·5 mill. long, is at first almost circular and flat, but it soon bends downwards and covers laterally the parts of the mouth and the basal joints of the feet. Posteriorly it exhibits a shallow sinuosity where it lies over the body. Whilst, at its first appearance, it separates from the body behind what are now the upper jaws, the separation is now effected behind the second pair of footjaws, and the carapace projects

freely over two or three of the newly formed segments. Anteriorly it is at first covered by the contiguous eyes (fig. 3); when these subsequently separate, it covers the interspace and the base of the ocular peduncles with a triangular process which runs out into a spine reaching a length of 0·12 mill. (fig. 6). The carapace has no other spiniform processes.

Beneath this anterior part of the carapace and the paired eyes is situated the *single eye*; the entire space between the origins of the anterior antennæ (0·1 mill.) is occupied by two large ganglia which meet in the median line; their anterior surfaces are strongly convex, and over both of them the integument is extended in a nearly semicircular form. From the depths of the free space thus left between the ganglia and the skin a clavate bacillus ("crystalline cone") rises until it nearly reaches the skin; at its lower part it is surrounded by black pigment-granules. The skin appears to me in this species to be destitute of lentiform thickenings.

The *antennæ* still form the chief instruments of locomotion; whilst in all other *Zoëæ* (of the Stomapoda, Crabs, *Porcellanæ*, *Paguri*, and the Prawns which quit the egg in the *Zoëa*-form) they have nothing to do with locomotion.

The *anterior* (inner) *antennæ* (0·4 mill. in length) now appear to be divided into four joints, the first of which occupies nearly half the length; the longest of the three strong apical bristles is nearly twice as long as the antenna. Close to the apical bristles and outside of them, stand one or two delicate bacilli, 0·09 mill. in length; there are one or two more of these a little below the apex on the outside of the terminal joint. The *posterior* (outer) *antennæ* are now close beside the inner ones, and attain only about two-thirds of their length; their thick stem shows two, their inner (anterior) branch three, and their outer (posterior) branch as many as ten joints. As before, the inner branch is but little shorter, although much weaker, than the outer one. The outer branch has as many as ten plumose bristles, of which four stand at the apex and the others at the ends of the six preceding joints.

The large *upper lip* (fig. 4 L) is very much in the form of the helmet of a Prussian soldier, which has only to be imagined rather broader and with its peak considerably enlarged and emarginated in the middle. The helmet, of which the point is directed forwards, is immoveable, and from it muscles pass to the moveable peak which covers the mouth and a part of the upper jaws.

In the examination of the uninjured animal from below, the only part of the powerful *upper jaws* (fig. 4 III) that is seen is a long tooth with two or three points, which projects far beyond the more deeply seated masticatory surface, which is beset with

small ridges and tubercles. At the base of the tooth, towards the masticatory surface, there are several stiff bristles, beset with short spinules (fig. 7). *The upper jaws are destitute of palpi.* This appears to be a peculiarity in which *all Zoëæ* agree with Insects, and which is in this case doubly remarkable, because not only does the perfect animal possess mandibular palpi, but even the younger larvæ have at this place biramose feet, from which the mandibles are produced.

In the *lower jaws* (*maxillæ*, fig. 4 IV, V) we distinguish—1. the peduncle with projections on its inner side, which have almost the appearance of joints, and are beset with strong bristles, partly spiniform and partly toothed or plumose; 2. a multiarticulate apical portion (inner branch?), which bears longer and more delicate bristles on its inside and at its apex; and 3. a small, elongated, lamelliform appendage (outer branch; *fouet*, Milne-Edwards, fig. 4 *a a*), on the margin of which are placed a few delicate setæ. In the first pair of maxillæ (IV) the peduncle has two long, and in the second pair (V) four shorter processes; the apical portion has in the former three, and in the latter five joints.

The *footjaws* (VI, VII) or *maxillipeds* appear to assist but little in locomotion. They consist of a thick peduncle (thickest in the first pair), a long 4–5-jointed inner branch, and a shorter inarticulate outer branch. Besides the apical setæ, there are bristles of various lengths upon the inner margin of the peduncle and of the inner branch, and also upon the outer margin of the outer branch. The first pair is longer and more powerful than the second.

The two branches of the *tail* project, separated by a semicircular notch, nearly at a right angle to each other; they appear to be rounded off at the apex, and twice acquire a new bristle on their inner margin, so that the number of these rises first to seven and then to eight on each branch. The oldest bristle continues to be recognizable by its greater length (0·4 mill.); the outermost bristle (the spine which is present even in the youngest *Nauplius*) continues to be distinguishable from the rest by its being smooth, whilst the others are rendered plumose by short spinules and longer hairs.

The alimentary canal presents no peculiarity; the *anus*, which is at first situated at the apex (Pl. IV. fig. 3), afterwards moves forward on the ventral surface nearly to the middle of the last segment (fig. 6). The *liver*, of a yellowish colour, consists of three pairs of wide tubes (one pair anterior and superior, one pair lateral, and one pair posterior and inferior), and does not differ in its structure from that of other *Zoëæ*.

The *heart* (fig. 3 *h*) occupies the usual position at the end of

that section of the body which is amalgamated with the carapace; with the progressive extension of the carapace the heart likewise moves its position further back. Thus, in the older *Nauplius*, it is situated above the third pair of feet (upper jaws), but now over the sixth and seventh (footjaws). The structure of the heart, however, differs remarkably from that of the older animals, and indeed of the other larvæ of Decapods. It resembles the foremost dilated section of the younger Stomapod larvæ recently described by me. The intercrossing trabeculæ of the interior are wanting, and there are only two fissures for the entrance of the blood, situated on the lower side of the posterior part of the heart. These two fissures are unusually striking; and I think I may state with positive certainty that they are the only ones. I have frequently and for a long time traced the course of the blood-globules through the heart and in its vicinity, and never seen them enter anywhere but here: I have sometimes seen blood-corpuscles coming from the fore part of the body glide along close by the heart, in order to reach these posterior orifices. Moreover the other fissures, which are subsequently easily distinguishable notwithstanding the internal apparatus of trabeculæ, could hardly now be overlooked in the simple sac. One vessel originates at the anterior extremity of the heart, and a second below its rounded posterior extremity. Valves were seen at the origin of the former. Other vessels seem to be wanting. A great part of the blood returning from the anterior part of the body takes a circuitous course through the carapace, as in other *Zoëæ*.

The above are the parts which remain nearly unaltered during the whole of this period.

Of the new parts which make their appearance, the *paired eyes* are to be regarded as the first in order of time; for their earliest traces were already recognizable in the oldest *Nauplius*. They form a mass of considerable size, lying above the anterior part of the carapace, and projecting beyond the frontal margin (fig. 3). Near their external posterior angle a black pigment-spot makes its appearance, from which radiating lines may soon be traced to the surface of the future true eye. Before and within this the thickened visual nerves may be distinguished, behind which there remains a free space, subsequently traversed by a muscle. The eyes, which are at first quite contiguous, now rapidly become separated, so that the central eye and the whole breadth of the ganglia between which it is situated again become visible from above.

Peculiar structures, the signification of which I do not know, and which appear to be deficient in other species observed, are the two hemispherical transparent buttons which project from

the frontal margin even in the oldest *Nauplius*. They appear at first as delicate, nearly globular, limpid vesicles (fig. 3 *o*), but subsequently as minute, firmer, and more opake mammiform appendages to the anterior margin of the ocular peduncles during the whole period of larval life (fig. 8 *o*).

The *new segments*, on which the thoracic and abdominal feet are afterwards developed, form at first an unjointed, soft, short zone, which, however, soon becomes elongated. Before this zone attains the length of the section of the body lying behind it, a division into eleven segments may be detected, although at first this is not very distinct. At first these segments are of nearly equal length, or the anterior ones may even be longer and more distinctly separated; but towards the end of this period the five posterior ones form about one-third of the entire length of the body, whilst the six anterior scarcely constitute one-ninth of it, the remainder of the length being half before and half behind these new segments*. The five posterior new segments (abdominal segments) acquire a short spine at the hinder margin in the middle of the back, and the last of them also one on each side. Of internal parts, only the intestine is at first clearly distinguishable in these new segments; the ganglionic chain is afterwards developed, and it is only towards the end of this period that the muscles become separated into sharply defined bundles.

The *new appendages* sprout from the ventral surface of the corresponding segments at first in the form of simple lobes, which, however, soon show a longer external and shorter internal branch. At first, and indeed when the separation of new segments just begins to be perceptible, the third pair of footjaws and the lateral laminæ of the caudal fan are produced; at a much later period the five pairs of thoracic feet make their appearance at once. Before the conclusion of this period, the branches of the footjaws acquire fully developed setæ, but still remain unjointed; the thoracic feet continue rudimentary and destitute of setæ. The lateral caudal laminæ which are attached directly (without a joint) to the basal joint, acquire a few short

* Whether the first of these eleven rings is already present (as I believe to be the case) at the commencement of this period—in other words, whether all the eleven, or only ten, segments are really to be indicated as new—I must leave undetermined. In the latter case, we should have,—in the first period (*Nauplius*) five original segments (antennæ, mandibles, tail) and the formation of five new ones (for the maxillæ and footjaws); in the second period (*Zoëa*) the formation of 2×5 new segments, of which some (thoracic segments) acquire rudimentary feet in this period, and the others (abdominal segments) only in the third period (*Mysis*-form). This simple relation, however, so far from applying generally, would not even suit all the species of the genus *Peneus*.

bristles, especially the apex of the longer external lamina; the long plumose setæ of a later period are still wanting. By the sprouting forth of the caudal appendages on the ventral surface, our animals are distinguished not only from the *Porcellanæ*, but also from those Prawns which quit the egg in the *Zoëa*-form, and in which, as in *Porcellana*, these lateral caudal laminæ are produced within the broad caudal fin.

The gradual changes which the appearance of the animal undergoes in consequence of the development of the paired eyes and the new body-segments and their appendages, are followed, when it has attained a length of about 1·6 mill., by a new fundamental and sudden metamorphosis—the change into the *Mysis*-form (fig. 8). The antennæ cease to serve for locomotion; they are replaced by the setigerous thoracic feet and by the long abdomen, which, having been hitherto painfully dragged along like a useless burden, now, by means of its powerful muscles, impels the animal rapidly with a jerking movement.

The *carapace*, with its frontal process still undenticulated, has acquired two short teeth on each side of its anterior margin—one over the eye, the other on the inferior angle. It soon entirely covers the thoracic segments, of which some at first remain uncovered, at least above.

The *anterior antennæ* have lost their long setæ. The first three joints now appear as a peduncle, a second branch, at first unjointed and running out into a simple seta, being developed inwards from the fourth bacilligerous joint.

The *exterior branch of the posterior antennæ* has become converted into the scale of the antenna of the Prawn, namely, into an unjointed leaf, the outer margin of which is furnished with a short tooth, whilst the more prominent apex and the inner margin are fringed with long plumose setæ. Close to this lamina, within and below it, there is a short, bristleless, unjointed lobe, from which the flagellum of the antenna is subsequently produced (figs. 8 II, 9). Whether this lobe is developed from the inner branch of the antenna of the *Zoëa*, or whether it is a new formation, whilst that inner branch entirely disappears, I must leave undecided: the latter appears to me most probable; and I think that the flagellum of the Prawn's antenna is to be regarded as the median branch (*palpe*, M.-Edw.).

The feet already existing in the *Zoëa* have undergone no particular change. The third pair of footjaws now resembles the two preceding ones. The five *new pairs of feet* are at first all of the same structure; the unjointed peduncle bears a short and likewise unjointed inner branch with two terminal setæ, and an outer branch, of twice the length of the other, annulated in its

apical half, and beset with long bristles; this is almost constantly in a whirling motion.

In the *tail*, the lateral plates are now moveably articulated upon a short basal joint and beset with long plumose setæ; the middle piece (the seventh abdominal segment) appears to be longer and narrower, as though the two divergent branches had been pressed together to almost complete amalgamation; the setæ of the *Zoëa* are retained in their full number, but contracted into short spines. The anus is situated at the base of this last segment.

About the same time a considerable alteration of the heart takes place; it acquires four new fissures for the entrance of the blood, and internal muscular trabeculæ.

In this *Mysis*-like form our larva was observed from scarcely 2 mill. to 4·5 mill. in length. During this period the auditory organs, the pincers, and ambulatory feet are developed, and the rudiments of the mandibular palpi, abdominal feet, and branchiæ make their appearance.

The flagella of the antennæ become elongated and divided into joints; in animals of 4 to 4·5 mill. in length the two flagella of the inner antennæ are three-jointed; the outer one, which is somewhat shorter, bears about seven bacilli; the flagellum of the outer antenna attains nearly the length of the scale.

In the basal joint of the inner antenna the *auditory* apparatus is formed. The lower third of this joint becomes inflated externally, the swelled portion having a crescentiform anterior margin. In the interior of this inflation an elongated cavity is soon observed (in animals of 3 mill. in length). A little later there appears in the cavity a globular, strongly refractive otolith, and in the crescent-shaped anterior emargination three or four short, plumose setæ, bulbous at the base (fig. 9). The otolith does not appear to lie freely in the cavity, but (as is the case in the tail of *Mysis*) to be supported by delicate filaments, which issue from a ganglion situated inwards from the cavity.

The extended spine of the *upper lip* begins to disappear, but is still recognizable as a minute point in animals of 4·5 mill. in length. The *palpi* make their appearance on the *mandibles*, about the time of the formation of the otoliths, in the form of small mamillæ, which are soon elongated, but remain unjointed and destitute of setæ.

The *pincers* (*chelæ*) are indicated, even in animals of 2·8 mill. long, by the still unjointed inner branch of the corresponding three pairs of feet acquiring a small process on the inner margin a little below the apex. In animals of 3·5 mill. in length, these feet are already divided into joints as in the mature animal, and this process (the immoveable finger) attains two-thirds of the

length of the apical joint (the moveable finger) which still bears its terminal bristles. In the fourth and fifth pairs of thoracic feet also, the inner branch is now divided into four joints, and already somewhat exceeds the outer one in length. In animals 4·5 mill. long, the fingers of the chelæ are of equal length; on the fourth and fifth pairs of feet an acute process (the claw) is visible beside the terminal setæ, and, especially in the fourth pair, the length of the true leg considerably exceeds that of the outer branch.

The *abdominal feet* are recognizable as small mammillæ even in animals of 2·8 mill. in length; they are at first simple, and, as in the case of the thoracic feet, it is the outer branch that is first developed. In animals of 4·5 mill. in length, they are already of considerable size, but still without joints or setæ, and the inner branch appears only as an insignificant appendage to the outer one.

The first rudiments of the *branchiæ* are recognizable, in animals below 4 mill. in length, in the form of small roundish excrescences at the base of the footjaws and chelæ, and subsequently also on the fourth pair of thoracic feet.

From the *Mysis*-like larva of 4·5 mill. in length there is but a small step to the Prawn-form. The youngest animals observed in this form were 5 mill. long. Their frontal process had three teeth above. The antennæ had undergone no change. The eyes no longer had any appendage: the median eye had become very indistinct. The upper lip had entirely lost its spine, and the mandibular palpi had acquired two joints and short setæ. The two anterior pairs of footjaws had approached close to the mouth, and become much shorter than the third pair. The outer branches of the thoracic feet, which are retained through life (as the so-called *palpus flagelliformis*) in many species of *Peneus*, had entirely disappeared. The abdominal feet had acquired joints and bristles (on the outer branch). The central plate of the caudal fan was diminished posteriorly, and bore on its straight posterior margin ten spines, of which those at the angles were the longest; on each lateral margin there were three shorter spines. The branchiæ (one over each fourth thoracic foot, and two over each of the preceding ones) were still elongated laminæ with entire margins (they are plumosely cut in animals 9 mill. in length). The liver had begun to acquire a more composite form by the formation of new sacs and the ramification of the old ones.

The animal was not observed more than 9–10 mill. in length.

A second larva is readily distinguishable from the preceding, in the later *Zoëa*-form, by the fact that the anterior margin of

the carapace has, besides the median spine-like process, a shorter one on each side, which is directed obliquely forwards and outwards. Moreover, when at the same grade of development, it is larger, and was seen as a *Zoëa* as much as 2·3 mill. in length. Younger *Zoëæ*, which still want the processes of the carapace, are so like those of the former species, that it was not without trouble that I learnt to distinguish them by the structure of the antennæ &c. Upon the median eye of this second species the skin usually forms two lentiform thickenings at the sides of the bacillus; once I saw a single larger one opposite to the bacillus. Between the two nervous cords of the ventral chain, a minute median filament may be distinguished running from ganglion to ganglion (this can hardly be wanting in the other species, but has not yet been distinctly seen in them). Notwithstanding its remarkable similarity to the former species, the course of development is somewhat different, the third pair of footjaws and the caudal appendages appearing not before, but simultaneously with the thoracic feet.

A third species was traced from young *Zoëæ* 1·2 mill. in length, in which the new segments were still of equal length, and the first rudiments of the third pair of footjaws and of the caudal appendages had just been formed, up to *Mysis*-like forms, 3 mill. long, furnished with three imperfect pairs of chelæ and abdominal feet. It is characterized by its being abundantly armed on the carapace and the segments of the abdomen with spinous processes; the median lamina of the caudal fan is also produced, in the *Mysis*-form, into two long points. The course of development appears to be precisely like that of the first species; the form of the basal joint of the inner antenna in the oldest observed larvæ (fig. 10) indicates that here also an ear is formed similar to that of the first species.

Of two other species whose *Zoëæ* closely approach the three preceding in the structure of the antennæ, of the spinose upper lip, of the multiarticulate second maxilla, of the tail, heart, &c., one was only traced to the non-cheligerous *Mysis*-form; the other, however, which acquires three pairs of chelæ, departs so widely from the rest in its mode of development, that I postpone the history of its metamorphosis for the present, in order to describe it separately.

EXPLANATION OF PLATE IV.

The figures of the animals are magnified 45 diameters; fig. 2, 180 diameters; and the rest, 90 diameters. The Roman numbers I.–XIX. indicate the appendages corresponding with the nineteen pairs of the mature animal: *g*, flagellum of the second pair; *a*, outer, *i*, inner branch of the appendages; L, upper lip; *h*, heart; *l*, liver; *l'*, anterior, *l''*, median,

l''', posterior sacs of the liver; *o*, appendage to the eye, of unknown import; *s*, median frontal process; *t*, orange-coloured oil-drops.

Fig. 1. Young *Nauplius* of a *Peneus*, from the sea of Santa Catharina; from above.
Fig. 2. Foot of third pair of an older *Nauplius*, with the rudiment of the mandible: A, from below; B, from the side.
Fig. 3. Young *Zoëa* of the same, from above.
Fig. 4. Parts of the mouth of the same *Zoëa*, from below.
Fig. 5. Eyes of a somewhat older *Zoëa*.
Fig. 6. Older *Zoëa* of the same, from below.
Fig. 7. Mandible of an older *Zoëa*.
Fig. 8. Young *Mysis*-form of the same species, from the side.
Fig. 9. Part of the basal joint of the inner antenna, with developed auditory apparatus, from a larva 4 mill. in length.
Fig. 10. Frontal process and inner antenna of the third *Mysis*-like larva, from above.

XII.—*Catalogue of Chrysomelidæ of South Africa.* By the Rev. Hamlet Clark, M.A., F.L.S.

Each of the three great regions in the southern hemisphere possesses a fauna (as we might expect) peculiarly its own: in the beautiful Coleopterous group the *Chrysomelidæ*, this fauna is represented in South America by the special genus *Doryphora* (which is the subject of the excellent monograph by Dr. Stål), in Australia by several special genera, *Phyllocharis*, *Australaca*, *Chalcomela*, &c. (which have been well and fully studied by Mr. Baly in his papers in the Entomological Society's Transactions), and especially by *Paropis*; and in South Africa by certain genera which have a nearer affinity to European forms than any of the preceding, but the species of which have never yet been critically examined. This I propose to attempt. By the kindness of my friend Mr. Baly, I have the advantage of access to his rich collection; and so I am encouraged to hope that the *comparatively few* South-African species may be without much difficulty determined.

The species of this paper includes the representatives of the two MS. genera *Atechna*, Chev., and *Centroscelis*, Chev. (Dejean's Catalogue, ed. 3, p. 427): I can discover no real difference between them; they both are united by Hope (Coleopterist's Manual, pt. 3. p. 164) under the name of *Polysticta*: his diagnosis is too brief, and not quite accurate; but it is clear that these are the forms which he had before him ("the majority of the species are remarkable for the number of the guttæ or spots with which they are adorned"); and hence it is right that his name should be preserved. The following analysis of the genus will explain the arrangement of the species.

Group Chrysomelinæ.

Genus Polysticta, Hope, Col. Man. pt. 3. 164.

A. Elytris flavis vel testaceo-flavis; nigro notatis.

1. nigro-signata, *Bhn.*
2. striata, *Fab.*
3. subcruciata, n. sp.
4. eburnipennis, n. sp.
5. 24-signata, *Thunb.*
6. macularis, *Dej.*, n. sp.
7. nigro-fasciata, n. sp.
8. pulchella, n. sp.

B. Elytris nigris vel rufo-nigris.

a. *Unicoloribus.*

9. lævigata, n. sp.
10. nigro-ænea, n. sp.
11. nigra, n. sp.

b. *Plagis longitudinaliter (plus minus irregulariter) signatis.*

12. Marshalli, n. sp.
13. picturata, n. sp.
14. lineolata, n. sp.
15. alternans, *Fabr.*
16. soluta, n. sp.

c. *Guttis sat æqualibus distinctis circularibus notatis.*

17. 14-guttata, *Fab.*
18. 20-guttata, *Chev.*
19. guttata, *Fab.*
20. 10-pustulata, *Thunb.*
21. 20-maculata, n. sp.

d. *Guttis inæqualibus, vel confluentibus vel irregulariter diffusis.*

22. notata, *Fab.*
23. modesta, n. sp.
24. multifida, *Dej. Cat.*
25. consimilis, n. sp.
26. simulator, n. sp.
27. elegantula, n. sp.
28. rufo-picta, n. sp.
29. 18-punctata, n. sp.
30. figurata, *Dej.*, n. sp.
31. difficilis, n. sp.
32. clathrata, *Dej.*, n. sp.
33. Hebe, n. sp.
34. flavo-sparsa, n. sp.
35. vulpina, *Fab.*

1. *P. nigro-signata*, Bhn.

P. ovalis, satis ampla, obsolete punctato-striata, rufa vel flavo-rufa, maculis nigris circularibus notata; capite inter oculos transverse arcuato-foveolato, impunctato, rufo; oculis oblongo-ovalibus: thorace transverso elytris angustiore, lateribus parallelis subtiliter marginatis antice rotundatis, disco subtiliter punctato, ad latera autem fortiter et crebre, rufo, maculis 5 circularibus ornato, 4 mediis (serie transversa ordinatis), 1 antice ad medium (hac interdum obliterata): scutello lævi, nigro; elytris sat convexis, striato-punctatis, interstitiis subtilissime etiam aliter punctatis, rufis, maculis plurimis nigris, circularibus, inæqualiter dispositis, aliquando confluentibus, interdum 20, interdum etiam 26, iterumque maculis confluentibus et vittas obliquas formantibus; corpore subtus pedibusque rufis; antennis rufo-fuscis, basi flavis.

Long. corp. lin. 3–4; lat. lin. $2\frac{1}{2}$–$3\frac{1}{3}$.

As will be evident from the above diagnosis, the species before us (assuming the examples from which it is taken to consist of one

species) is very variable both in size and markings. I have three examples—two from my own cabinet (from the Chevrolat and La Ferté collections) and one from Mr. Baly's; and each of these three differs materially from the other two. The circular black markings in one are insular, in the others are more or less confluent, and in none are they disposed according to any arrangement common to either of the other examples. I have no doubt that they constitute one species, although obviously I am unable to record its typical pattern or its limits.

Chevrolat's example is labelled with the name "*nigrosignata*, Bohn." : I have adopted it, although I am unable to discover any published description of M. Boheman's of the species.

Port Natal.

2. *P. striata*, Fab. Ent. Syst. i. 321. 65; Syst. El. i. 426. 21.

P. ovalis, minus convexa, distincte punctata; capite æneo-nigro; thorace elytris angustiore, lateribus rotundato-angustatis, angulis anticis distinctis, ad latera dense et subfortiter, ad medium sparsim punctato, æneo-nigro; scutello lævi, æneo-nigro; elytris obovatis, thorace latioribus, distincte et regulariter punctato-striatis, rufoflavis, sutura tenuiter fusco-nigra; corpore subtus æneo-nigro; abdominis segmentis ad apicem rufo-marginatis; pedibus antennisque æneo-nigris.

Long. corp. lin. 3; lat. lin. $2\frac{1}{4}$.

This species can only be confounded with the following, *P. subcruciata*, from which it is readily separated by its immaculate thorax and by the well-defined and distinct stria-like punctures on the elytra.

From South Africa; but I am uncertain of the exact district. In the cabinets of Mr. Baly and the Rev. H. Clark.

3. *P. subcruciata*, n. sp.

P. ovalis, minus convexa, subtiliter punctata, stramineo-flava; capite nigro, inter oculos macula longitudinali (ad medium divisa) straminea; thorace lateribus ad basin parallelis, antice rotundatis, angulis anterioribus acutis, lateribus dense et fortiter punctatis, disco impunctato, antice nigro-marginato, maculis quatuor subquadratis (duabus ad latera, duabusque ad medium positis) ad basin etiam marginato, maculis tribus, una undique inter scutellum et latus (his transversis), tertiaque ad medium minuta longitudinali; scutello plano: elytris thorace admodum latioribus sat rotundatis, leviter punctato-striatis (striis juxta latus confusis), interstitiis impunctatis; stramineo-flavis (ad margines laterales vitta pallidiore), sutura maculisque tribus nigris, sutura tenuiter et inæqualiter nigra, infra medium macula undique communi triangulari striam quartam attingente, maculisque alteris duabus minutis, una ad medium latus undique transversa alteraque juxta

apicem longitudinali: antennis nigris, ad basin rufo-nigris vel rufis: corpore subtus pedibusque nigris.

Long. corp. lin. $3\frac{1}{4}$; lat. lin. $2\frac{3}{4}$.

It is impossible to say, from the single example before me, whether the markings on the elytra of this species are constant; it is probable that one or other of them may be entirely obliterated; at all events, the species, whatever may be the degree of markings, is amply different from all others of this paper. The peculiar markings of the thorax (very much resembling those of *P. guttata*, Fab.) and the *almost obsolete* punctures on the elytra sufficiently distinguish it.

A single specimen from the Cape, taken by Drégé, I received in M. Chevrolat's collection.

4. *P. eburnipennis*, Chev., n. sp.

P. ovalis, lente punctato-striata, pallide testacea; capite minute et sparsim punctato, inter oculos transverse striato, nigro; thorace lateribus antice rotundatis, apud margines valde, ad medium leviter punctato, nigro; scutello subtriangulari, lævi, nigro; elytris thorace latioribus, subrotundatis, punctis nigris minutis irregulariter ordinibus dispositis, pallide testaceis, seriebus macularum transversis tribus, prima ad basin maculas quatuor magnas longitudinales continente (3^{tia} et 4^{ta} juxta latus confluentibus), secunda ad medium maculis minoribus tribus instructa, tertiaque juxta apicem maculis minutis 6 (vel forsan 4 vel 5 plus minus confluentibus), ad apicem undique macula minuta; maculis, sutura, marginibusque nigris; corpore subtus nigro; antennis nigris (articulis 3 vel 4 ad basin rufo-flavis); pedibus nigris, tarsorum art. ultimis pallide flavis.

Long. corp. $3\frac{1}{4}$ lin.; lat. lin. $2\frac{3}{4}$.

The above description is based on two specimens—one from the collection of Mr. Baly, and one which I received from M. Chevrolat. The species differs entirely from *P. 24-signata*, Thunb., both in punctuation, in arrangement of the three transverse rows of maculæ, and also in the colour of the thorax. I can conceive that in its maculations the species may be subject to some variation.

This is the only species known to me that agrees with the short description given by Fabricius (Ent. Syst. Supp. 86. 26; Syst. El. 1. 432) of *P. ebroëa*. I have no means, however, of verifying it.

From the Cape of Good Hope.

5. *P. viginti-quatuor-signata*, Thunb. (teste Chev. coll.).

P. ovalis, sat gibbosa, fortiter punctato-striata, rufo-ferruginea, nitida; capite distincte punctato, inter oculos bidepresso, nigro,

fronte transverse flavo maculata; thorace lateribus subparallelis, antice sat rotundato, sparsim subtiliter, ad latera fortius punctato, maculis tribus indistinctis fuscis vel fusco-nigris, una ad medium minuta (interdum vero suffusa juxta basin) alteriaque undique obliqua, vel minuta vel basin attingente; scutello subtriangulari, nitido nigro: elytris fortiter punctato-striatis, punctis ordinatis approximatis, maculis undique 12; 3, 4 (obliquis et majoribus), 3, et ad apicem 1; maculis nigris, plerumque rectangulis, oblongis, et striis macularum circumscriptis; corpore subtus rufo-fusco vel fusco; abdominis apice et pedibus antennisque rufo-flavis.

Long. corp. 3 lin.; lat. $2\frac{1}{4}$ lin.

One of the more common species, and apparently subject to but slight variation: the markings on the elytra are almost constant, being very seldom indeed confluent; the thorax is subject to greater modification of colour.

I adopt the name which I find appended to this species, although I cannot discover the reference to any description by Thunberg in 'Act. Reg. Soc. Ups.' viii., where he published several, but very insufficient, descriptions of Cape insects.

6. *P. macularis*, Dej. Cat., n. sp.

P. ovalis, crebre et sat fortiter punctata, rufo-flava, nigro tristriata; capite valde punctato, nigro, antice et ad medium longitudinaliter flavo; thorace angulis anticis subrotundatis, lente et sparsim punctato, rufo-flavo, maculis 4 irregularibus (aliquando distinctis subcircularibus, aliquando magnis, longitudinaliter dispositis); scutello subcordiformi, lævi, nigro, nitido; elytris sat fortiter punctatis, ordinibus macularum transversis duabus, hac ad basin plagis tribus, illa pone medium maculis (minoribus) tribus instructa; maculis nigris, etiamque aliquando tenuiter sutura marginibusque; corpore subtus nigro, abdominis segmentis rufo-flavis; antennis pedibusque rufo-flavis.

Long. corp. lin. $2\frac{3}{4}$; lat. lin. 2.

A common species at the Cape, and one that, being subject to some variation of pattern, has been provisionally recorded by collectors under different names, as *P. lineolata*, *P. pulchra*, &c. It certainly is entirely distinct in all its patterns from *P. notata*, Fab., with which it has been confounded, as being a permanent variety. The thorax varies as to pattern, in different examples, from rufo-flavous, with four isolated subcircular markings, to black, the sides and a medial line only being flavous; and the elytra in some specimens before me have the two series of markings continued into each other: in all examples, however, these longitudinal markings terminate a little behind the middle, leaving the apex broadly rufo-flavous. In pattern the species approaches *P. eburnipennis*; the latter insect, however, besides

differing in colour of thorax, is much broader medially; its thorax also is more rounded in front.

7. *P. nigro-fasciata*, n. sp.

P. ovalis, penitus rotundata, punctato-striata, flavo-rufa, nitida; capite nigro-cæruleo; thorace transverso antice rotundato, angulis anticis distinctis, lateribus tenuiter marginatis, disco sparsim punctato (in medio leviter, ad latera fortius), nigro-cæruleo; scutello lævi, nigro-cæruleo; elytris brevibus, sat amplis, punctato-striatis (punctis confertis distinctis æqualibus), flavo-rufis; sutura (tenuiter), vitta media (lata, marginem versus ampliore) alteraque juxta apicem (inter striam 7 et suturam, indeterminata) æneo-nigris; corpore subtus, antennis pedibusque nigris.
Long. corp. lin. $2\frac{1}{2}$; lat. lin. 2.

A very distinct and beautiful species, of which a single example is in my cabinet, from the Chevrolat Collection, labelled from the Cape of Good Hope. It differs from *P. pulchella* in having the medial band extended to the margin, and the apical marking not well defined as in that species, but indeterminate and merging anteriorly into simply black punctures.

8. *P. pulchella*, n. sp.

P. ovata, sat convexa, punctato-striata, rufo-flava; capite transverse arcuato-foveolato, nigro: thorace transverso, latitudine fere dupla longitudinis, lateribus ad basin parallelis, ad apicem rotundatis; disco subtilissime punctato, rarius sed fortiter ad marginem ipsum, æneo-nigro: scutello triangulari, lævi: elytris sat rotundatis, punctato-striatis, punctis æqualibus, minutis, ad apicem obsoletis; colore rufo-flavis, maculis quibusdam nigris, 1. a medio basi (haud suturam attingens) oblique ad striam 10^{mam}, indeque per striam 10^{mam}, apicem versus sed haud attingens; 2. transversa, antemedia, lata, a sutura usque ad striam 6^{tam}, et inde macula 1^{ma} confluens; 3. altera postmedia, brevis, obliqua apicem versus, striam 4^{tam} attingens (hanc juxta undique, inter strias 4^{tam} et 5^{tam} macula parva, insulata); 4. apicalis, inter strias 4^{tam} et 5^{tam}, subcircularis; sutura etiam (latior) et margines (subtilissime) nigrini apparent: corpore subtus, pedibus antennisque nigris.
Long. corp. lin. $2\frac{1}{2}$; lat. lin. 2.

A beautiful species, and apparently quite distinct from others: to be distinguished from *P. nigro-fasciata* (*inter alia*) by the narrowness of the antemedial and the presence of a postmedial transverse fascia.

In the cabinet of Mr. Baly, to whom I am indebted for the opportunity of describing it here with its congeners.

9. *P. læviyata*, n. sp.

P. ovalis, sat rotundata, subtiliter punctata, rufo-nigra, nitida; capite inter oculos triangulariter depresso, nigro; thorace lato, lateribus

antice sat rotundatis, etiamque leviter marginatis, sparsim et subtiliter punctato; scutello minuto, triangulari; elytris subrotundatis, subtiliter et subremote punctatis; corpore subtus, abdomine, antennis pedibusque rufo-fuscis.

Long. corp. lin. 4; lat. lin. 3.

This species is peculiar among the others of this paper by being the only one in which the punctures are not arranged in striæ, but are scattered without arrangement over the whole surface of the elytra.

I received a single specimen from the collection of the Marquis La Ferté, taken at the Cape.

10. *P. nigro-ænea*, n. sp.

P. ovalis, punctata, nigro-ænea, nitida; capite inter oculos transverse et subcirculariter depresso, brevi; thorace lato, lateribus parallelis, antice rotundatis; angulis anticis haud acuminatis, lateribus tenuiter marginatis, subtiliter et sparsim punctato; scutello triangulari, lævi, nigro; elytris fortiter punctatis, punctis sat confertis, vix striis dispositis; corpore subtus, abdomine, pedibus antennisque rufo-nigris.

Long. corp. lin. $3\frac{1}{4}$; lat. lin. $2\frac{1}{2}$.

With the exception of *P. lævigata*, this is the only species that I know that is absolutely and entirely concolorous. From that species it differs by its much smaller size and the arrangement of the punctures on the elytra; there is something like the stria-like rows which generally obtain, though these are very uneven and irregular.

A single specimen from the collection of M. Chrevrolat.

11. *P. nigra*, n. sp.

P. ovata, sat rotundata, punctato-striata, nigra; capite fovea inter oculos armata transversa, rufo; thorace elytris angustiore, lateribus ad basin parallelis, antice rotundatis, disco sparsim et subtiliter sed apud latera fortius punctato, rufo, margine basali late nigro; scutello lævi, nigro; elytris thorace latioribus, punctato-striatis, punctis æqualibus, haud apicem versus obsoletis; corpore subtus fusco-nigro; antennis pedibusque rufis vel rufo-fuscis.

Long. corp. lin. 3; lat. $2\frac{1}{5}$.

I register this as the typical pattern of a new species, although it is possible that it may ultimately be proved to be but a dark variety: it has no such relationship, however, to any of the species before me.

The only example that I know was received by my friend Mr. Baly from Port Natal, and is in his cabinet.

12. *P. Marshalli*, n. sp.

P. ovalis, punctato-striata, nigro-ænea, nitida; capite inter oculos

transverse et subcirculariter depresso, leviter punctato; thorace sat parvo, lateribus haud parallelis, apicem versus distincte angustatis et rotundatis, angulis anticis haud acutis, ad latera fortiter et confertim, ad discum leviter et rarius punctato, nigro-æneo, lateribus late rufis; scutello subtriangulari, lævi, rufo-fusco; elytris seriatim punctatis, basi, marginibus plagisque longitudinalibus 3 rufis; corpore subtus, pedibus antennisque fusco-nigris.
Long. corp. lin. $2\frac{1}{2}$; lat. $1\frac{3}{4}$ lin.

The longitudinal markings in this species may perchance be subject to variation: in the single example before me they are ranged—(1) between the 2nd and 3rd striæ, from the basal colouring to the middle; (2) between the 3rd and 4th striæ, as a small medial spot of rufous; (3) between the 4th and 5th striæ from in front of the middle to the apex; (4) between the 6th and 7th striæ, and here subdivided into three markings,—*a*, from the basal markings to before the middle; *b*, a postmedial, shorter, and more obscure marking; *c*, a subcircular spot near the apex. It is quite possible that, in some examples, markings 1, 2, and 3 may be confluent, and also that those under 4 may be continuous.

I know of one specimen only of the species, which I received from the collection of M. Chevrolat. In naming it, I desire to testify my sense of obligation to my friend the Rev. T. A. Marshall, who is undertaking the Herculean task of systematizing the Eumolpidæ, and who already gives ample encouragement for us to believe that success will attend his labours in a field confessedly most difficult, as well as at present unmeasured in extent.

13. *P. picturata*, Chev., n. sp.

P. ovalis, punctata, nitida, nigro-ænea; capite læviusculo, nigro; thorace ad latera rotundato, immarginato, nigro-cyaneo, ad medium disci rarius, ad latera fortiter et frequenter punctis adsperso; scutello triangulari, nigro, lævi: elytris sat latis, punctato-striatis, punctis intervallo distantibus; nigro-æneis, notis quibusdam flavis; inter strias 1. et 2., 3. et 4., 5. et 6., 7. et 8., vittis longitudinalibus, 1^{ma} a basi, penitus ad medium, 2^{da} a basi ad apicem, 3^{tia} a basi, sed apicem haud attingente, 4^{ta} media, nec basin nec apicem pertingente; vitta 1. et 2. maculis duabus connexis, 2. et sutura una macula pone medium, 2. et 3. una, juxta apicem, 3. et 4. tribus, ad medium et undique ad terminum, 4. et margine duabus, media et postmedia, marginibus ipsis *late* flavis; corpore subtus, pedibus antennisque (harum baseos articulis rufo-fuscis) nigris.
Long. corp. lin. 3; lat. lin. 2.

At first sight this species nearly resembles *P. lineolata*, the longitudinal markings being generally similar; over and above the contrast, however, which, on examination, will be apparent in the patterns, the species before us may readily be separated

by the punctuation of its striæ; the punctures are separated, with an interval between them of four or five times their own breadth, whereas in *P. lineolata* they are much closer.

A single example from M. Chevrolat's collection, from the Cape.

14. *P. lineolata*, n. sp.

P. ovalis, leviter punctata, ænea vel æneo-nigra, flavo maculata, nitida; capite obscure et sparsim punctulato; thorace antice rotundato, apud discum ad medium leviter, ad latera confertim et fortiter punctato; scutello elongato triangulari; elytris sat rotundatis, leviter sed confertim striato-punctatis, striarum interstitiis flavo vittatis, interstitio 1^{mo} inornato, 2^{do} omnino flavo, 3^{tio} vittis 3 brevibus (ad basin, ad medium et longius apud apicem) flavis, 4^{to} omnino vel ex magna parte flavo, 5^{to} omnino vel ex magna parte æneo-nigro, 6^{to} flavo (intervallo ad medium excepto), 7^{mo} æneo-nigro (vittis parvis duabus flavis), 8^{vo} et 10^{mo} omnino flavis, 9^{no} æneo-nigro, macula una ad medium flava; corpore subtus, pedibus antennisque (articulis basalibus exceptis) nigris.

Long. corp. lin. 3; lat. lin. 2.

This species, in the *form* and pattern of its markings, entirely differs from *P. picturata*, Chev.; and, independently of its markings, may readily be recognized by the *close* arrangement of striated punctures on its elytra.

A single example from the collection of M. Chevrolat.

15. *P. alternans*, Fab. Ent. Syst. iv. App. 447. 65*; Syst. El. i. 426. 22.

This pretty species may be briefly characterized as æneo-piceous, with four darkly rufous bands on the elytra between alternate striæ: it seems to vary somewhat in size, but not in pattern, and to be not uncommon at the Cape. I have received it from the Continent, and also from Mr. Stevens.

In Mr. Baly's collection, that of Mr. Wilson Saunders, and my own.

In Fab. Syst. El. this species is inaccurately registered as from the American islands.

16. *P. soluta*, Dej. Cat., n. sp.

P. ovalis, sat convexa, punctato-striata, æneo-nigra, vittis 6 flavis; capite nigro; thorace latitudine dupla longitudinis, lateribus rotundatis et tenuiter marginatis, disco subtiliter (margines versus fortiter) punctato, æneo-nigro; scutello lævi, æneo-nigro; elytris fortiter punctato-striatis (punctis crebris, ordine dispositis et sat profundis), æneo nigris, vittis tribus undique flavis (1^{ma} inter strias 2. et 3. a basi ultra medium, et inter strias 3. et 4. a medio ad apicem, 2^{nda} inter strias 6. et 7. ab humeris ultra medium, et inter strias 7. et 8. a medio juxta sed haud attingente apicem, 3^{tia} ab humeris inter

striam 10. et marginem usque ad apicem), basi quoque (a scutello ad humeros) flavo; corpore subtus, pedibus antennisque nigris.
Long. corp. lin. $2\frac{1}{2}$; lat. lin. 2.

A species which may at once be recognized by its four flavous bands, each of which is broken, and, as it were, overlaps itself medially.

From the Chevrolat collection; received from the Cape of Good Hope.

[To be continued.]

XIII.—*Histological Researches on the Formation, Development, and Structure of the Vegetable Cell.* By Prof. H. Karsten.

[Continued from p. 36.]

§ X.

Formation of new joint-cells by the internal development of tertiary cells, and of the daughter cells contained within the secondary cells.—Folds in the wall of the mother cell.

In the different species of the genus *Spirogyra* the distinctness with which the changes just described as undergone by the endogenous cells may be recognized is very variable, and it appears even to differ in the same species at its different periods of development, or under different conditions of nourishment.

Although I observed a great number of *Spirogyræ*, it was especially in *S. nitida* and *S. orthospira* that I saw the development of the nuclear cell of which I shall here endeavour to give a general picture; and although this may be subject to modifications in detail for the different species, or their particular conditions of development, it nevertheless gives the certain result that in these plants also the cell-multiplication is effected by endogenous cell-formation, as indeed was to be expected.

If we trace, in the first place, the changes which are to be recognized in the cell-nucleus with its daughter cells, we have in the developmental condition represented in Plate VII.* fig. 85 an indication of the production of the septum in the mother cell by the flattening of the two daughter cells which enclose the nucleus of the mother cell between them.

The further development of this cell-system takes place usually as follows:—Simultaneously with the absorption of the nucleus of the mother cell new cells are produced in the daughter cells; the latter expand either in breadth, and then in the region of their central, contiguous and flattening walls, or in length; and at the same time their mother-cell membrane (the original membrane of the nucleus) seems gradually to disappear. The new nuclei of the two daughter cells are situated on their walls

* The Plate here referred to will be found in the June Number.

which are directed towards the extremities of the mother cell; between these and the septum produced by the mutually opposed membranes of their primary cells a system of mucilaginous filaments makes its appearance in the direction of their radii, indicating the formation in them of secretion-cells similar to those of the mother cell. These cells may be brought into sight by the action of dilute solution of tannin and of some other endosmotic fluids.

Upon the different directions of growth of the two daughter cells (*i. e.* whether they extend themselves more in the first or the second of the indicated directions) depends both the greater or less removal of the nuclei of the daughter cells from the median line of the mother cell at the appearance of the septum, and also the modifications in the mode in which this septum becomes visible at the surface of the joint-cell.

If the daughter cells at first follow especially the first indicated direction of growth, *i. e.* if they increase most in breadth, their central flattened walls attain the surface of the joint-cell, whilsttheir free peripheral portions directed towards the extremities of the mother cell scarcely form a hemispherical surface. These mutually flattened walls appear, on coming into contact with the wall of the mother cell, as the new septum.

The membranes of the secondary cell of the joint-cell, as also the chlorophyll-sac applied to their inner surface, cover the outer circumference of the septum, and even conceal it when a starch-vesicle or an opake chlorophyll-vesicle lies immediately upon it.

If, however, the daughter cells extend at first less in this direction than in the direction of their length, so that their free surface, instead of becoming hemispherical, approaches more or less to a spherical form, those phenomena occur which have hitherto been usually observed and described as the normal process.

In this state (in which the small secretion-vesicles surrounding the cell-nucleus are in process of absorption, and therefore collapse readily by any diosmotic process) the secondary cell, with the adherent chlorophyll-sacs, readily sinks down upon the more or less spherical daughter cells, which, however, always have a part of their surface flattened against each other, forming the depression which is frequently observed and regarded as a preliminary of the septum-formation.

That this fold-like depression is not essentially connected with the formation of the septum, but that it occurs only in a less complete and not perfectly regular course of development, appears from the circumstance that it is met with chiefly in cultivated plants, or in those which have grown in their natural

habitat when these have been long upon the slide, and brought into contact with different kinds of water.

A less degree of this depression appears, however, to occur even in plants growing in a natural state; and this is of interest here, because it induces the fold-formation which was formerly regarded as the cause of cell-multiplication, when the depression occurs at the precise period at which the two more or less spherical daughter-cells, touching the large secretion-cells with their peripheral surface, and hampered by these in their rapid growth, bring the previously free parts of their central surface into complete contact, and thus enclose this impressed membrane between them. The depth to which the folds of the secondary cell is enclosed in the septum in course of formation depends upon the greater or less extent of contact of the central surfaces of the daughter cells at the time of this process.

By a curvature or depression of one or the other of the chlorophyll-sacs, the side of the joint-cell is already perceptible, on which the liquefaction of the small secretion-cells situated about the nucleus takes place more rapidly than the enlargement of the neighbouring young joint-cells, which usually occurs simultaneously with it.

Newly formed septa not unfrequently occur, which on one side do not enclose the smallest trace of a fold of the mother cell between them, but show the well-preserved chlorophyll-sacs distinctly at their circumference (as represented in fig. 58 *a*, in *S. nitida*), whilst on the other side of the periphery of the mother cell a fold of this kind is engaged, more or less deeply, between the two plates of the septum.

These enclosed folds of the membrane of the secondary cell, which are no doubt subsequently absorbed, are at first thickened, reminding us of the folds of *Cladophora*, described at pp. 420 and 425 (vol. xiii.), as well as its peripheral portion, whilst the chlorophyll-sacs appressed to them are immediately absorbed.

The thickening of the membranes of the daughter cells, which takes place immediately, and their amalgamation with those of the mother cell commence in the portions forming the septum even before the completion of the absorption of the chlorophyll-sacs which surround them.

When the absorption of these secretion-materials is much delayed, the new, half-thickened septum may be seen, in certain positions, already united on each side to the membrane of the mother cell, after the joint-cell has been treated with endosmotic fluids, whilst it is still free beneath the chlorophyll-sacs. Figs. 74 and 75 show this in one sac.

But phenomena do occur which seem to show that in the *Spirogyræ* the development into new joint-cells does not always

belong exclusively to the cell-nuclei as above described, but that the two large secretion-cells (figs. 61 and 72) may constitute the foundation of the new joint-cells; in many species these show their relationship to the tissue-cells by their enclosing two large and often many smaller cells.

These two secretion-cells, which gradually become so much enlarged that at length they fill the whole cavity of the joint-cell (the other equivalent cells diminishing at the same time), consequently represent the two colourless, rapidly enlarging daughter cells, which become developed into new joint-cells, and which, in *Œdogonium*, may be recognized as being of this nature by direct observation throughout all their stages of development.

This, however, has not hitherto been possible in the case of the very fragile *Spirogyræ*, and hence we are compelled to combine many observations of details in order to obtain a connected picture of their mode of development; and in this errors are all the more likely to creep in, as the investigation of the development of the colourless cells in the interior of the joint-cells must be assisted by reagents, the mode of action of which is not yet satisfactorily ascertained.

Let us first consider those species in the elongated joints of which cell-nuclei are present, but do not appear to produce any daughter cells. If this be really the case, the new joint-cells in these species would be normally formed within the secondary cell of the joint-cell.

Fig. 74 represents a joint-cell of *S. Weberi*, which is divided into two halves by the newly formed, delicate, and still flat septum, whilst the chlorophyll-sac, completely coherent, is still closely applied to the inner surface of the mother cell, as has already been described in *S. princeps*. If this condition be observed for a few hours, we may see distinctly how the substance of the chlorophyll-sac, at its point of contact with the septum, loses its green colour, and finally becomes completely absorbed; in from four to five hours this process has advanced to the condition represented in fig. 76, in which the chlorophyll-sac is divided into two perfectly separate portions. At this time the septum does not yet exhibit any indication of the annular fold which is subsequently formed.

No doubt, during this absorption of the secretion-material of the mother cell, corresponding new formations take place in the daughter cells, but these cannot be observed here as in *Œdogonium*.

A phenomenon which is probably repeated in most young tissue-cells is, that the organized secretion-materials, and especially the starch and chlorophyll, adhere during their growth to

the inner wall of the membrane of the secondary cell, which is then likewise engaged in development. But afterwards, when a more active assimilative energy is acquired by the previously resting nuclear cell for the purpose of its progressive or retrograde metamorphosis, or when daughter cells are developed by the side of it, the secretion-vesicles separate from the wall of the secondary cell, and either float in the cell-juice or sink down upon the endogenous cells which are in a state of absorbent activity, and in the fluid contents of which new secretion cells are produced, at first floating in the cell-juice, but subsequently adhering to the inner surface of the secondary cell-membrane.

The vesicles in the products of decomposition of the contents of the mother cell and daughter cells, mentioned at p. 30, indicate the occurrence of such a regeneration of the secretion-cells, simultaneously with those of the endogenous tissue-cells. The vesicles containing chlorophyll, however, can never be proved with certainty to be at the same time contained in both the mother cell and the daughter cells. Under the conditions assumed, it seems to me that they would clothe the outer and inner surfaces of the membranes of the daughter cells in such a manner as to correspond with each other.

Moreover some phenomena seem to show that, simultaneously with the absorption of the chlorophyll of the mother cell, it is again re-formed in the enlarged daughter cells, which completely fill the mother cell (figs. 74 and 76); but these do not prove the fact quite satisfactorily.

Thus, simultaneously with the absorption of the chlorophyll-sac over the new septum (fig. 74), a new formation of chlorophyll is perceived near this spot, and, by this, a prolongation of the separated extremities is produced, of such a nature that the one extremity grows more to the right, and the other more to the left at the periphery of the new septum. This newly formed chlorophyll is always of a lighter green colour than the old sac, and of course does not contain the large starch-vesicles. That these are newly formed parts is evident, but it cannot be determined whether the appearances are due, as seems probable, to the prolongation of a new sac situated within the daughter cell beneath the old sac, or to the direct prolongation of the partially absorbed sac itself.

By the action of solution of glycerine or chloride of calcium upon cells in course of septum-formation (figs. 74 and 76), phenomena are produced very similar to those observed in the cell before division (figs. 78 and 79), but very different in their nature.

In the case represented in figs. 78 and 79, the delicate

secondary cell, with its internally adhering chlorophyll-sac, is contracted upon the two daughter cells as described at p. 29; it is finally ruptured between them in the middle, in common with the chlorophyll-sac, which is here likewise drawn out into a thread-like form.

In the developmental condition shown in fig. 75, it is the daughter cells, converted into new joint-cells (with their endogenous cells still nearly undeveloped and of equal size), that separate from their primary cell-membranes and contract upon the entire solid contents, their fluid contents being at the same time evacuated by exosmose.

The septum is quite uniformly thickened, and only perforated at the point where the chlorophyll-sac is situated,—not, however, in the centre of the septum, as must have been the case in accordance with the notion of septum-formation by an annular fold of the membrane of the mother cell constricting its contents, but, in correspondence with the position of the chlorophyll-sac before the action of the reagent, at its periphery.

This is seen very distinctly when the septum, formed by the mutual apposition of the endogenous cells, touches the chlorophyll-sac at the point where it contains one of the large thick-walled starch-vesicles, which requires a long time for its absorption. For if the septum strikes the chlorophyll-sac at a thin spot between its more solid contents, the sac is usually torn, during the action of the reagent, by the pressure exerted by it upon the membrane to which it adheres, the appearance being then as represented in fig. 77.

The thickening of the primary membrane of the daughter cell, which commences at the same time with the formation of the septum, as also that of the secondary membrane of the mother cell, advances from the septum towards the ends of the mother cell; and in consequence of this the remarkable phenomenon occurs, that the chlorophyll-sac at the ends distant from the septum is covered by a membrane (figs. 75 & 77), whilst near the septum (before its absorption) it lies freely upon the surface of the contracting endogenous cells.

This is probably explained by the fact that the secondary membrane of the mother cell, as also the primary membrane of the daughter cell, is no longer contracted by the above reagents in the immediate vicinity of the septum, as they have passed here from the soft and viscous into the compact and resistant condition; at some distance from the septum this contraction takes place, and therefore the membranes are ruptured at the limit between these two states of aggregation.

The soft and viscous state of the cell-membranes appears to me to be characteristic of the period of development which pre-

cedes the thickening of the cell-membrane. Before this transition-state the cell-membrane is more delicate, but more elastic; it then loses its elasticity, becomes thicker, appears to be swelled up and nearly gelatinous, and finally becomes again condensed and solid.

When the absorption of the chlorophyll-sac is completed above the new septum, it then probably advances towards the ends of the mother cell (the alteration of the membranes of the neighbouring cell-membranes and the production of new chlorophyll in the interior of the daughter cells going on simultaneously), and the contraction of the unthickened membrane of the daughter cell, in consequence of the action of dilute diosmotic fluids, exhibits the customary appearance, the separation of the membranes of the septum taking place at length, not in the centre, but in the periphery (figs. 76 & 77). It then presents a great similarity to those in which the mother cell is still undivided (figs. 78, 79). But in the former case the contracting membrane of the mother cell tears in the middle between the two contracting daughter cells; in the latter, if a rupture takes place, it is in the vicinity of the ends of the mother cell.

In order to explain this mode of formation of the septum by fold-formation, we should have to assume here that the fold of the membranes of the joint-cell grows through the cavity of the cell from one side to the other, commencing always from the side opposite to the chlorophyll-sac, and terminating at the opposite wall by applying itself closely thereto (figs. 74, 75).

In opposition to this supposition, I may state that I have never yet seen an ingrowing fold of this kind in the long and thin-jointed species which I have observed, but that I have very frequently watched the formation of the septum in all its stages, from the first moment at which it is recognizable as a delicate and scarcely measurable membrane stretched transversely across the cavity of the cell, with the perfectly continuous chlorophyll-sac passing close beside it as above described, up to the completion of the absorption of the latter at the boundary of the septum, which has in the meantime been increasing in thickness.

This mode of septum-formation by means of daughter cells of the secondary joint-cells occurs also in those *Spirogyræ* which contain several chlorophyll-sacs in their joint-cells, and perhaps quite as frequently as the one above described (p. 124) by the daughter cells produced in the nuclear cell.

In both cases the presence of several chlorophyll-sacs enables us to determine with perfect certainty whether, simultaneously with the production of the septum by endogenous cells, a fold-formation of the mother cell has or has not taken place. Even when the daughter cells of the secondary joint-cells formed the

new tissue-cells, I have frequently seen that all the chlorophyll-sacs lay completely continuous over the new septum.

In this mode of multiplication of the joint-cells the nucleus of the mother cells appears to be always absorbed, whilst new nuclei make their appearance in the new joint-cells.

I observed this mode of development chiefly in *S. decimina* and *S. nitida*. *S. orthospira* is less adapted to this purpose, on account of the delicacy of the walls of its chlorophyll-sacs. For my investigations I employed slides of very thin glass, so that by turning them over I could examine the object on both sides, with high powers, without disturbing its position.

Figs. 59–61 represent different states of *S. nitida* during this septum-formation.

In fig. 61 the two daughter cells, still destitute of nuclei, are somewhat contracted by dilute solution of glycerine, and covered by the membrane of the secondary mother cell, which is likewise contracted. The chlorophyll-sacs, which at this period frequently, although not always, lie parallel to the septum at the point of contact of the two endogenous cells, are here, after the contraction of the daughter cells, coiled up together over the nucleus of their mother cell.

In fig. 59 the nucleus of the mother cell was seen at *a* in course of absorption, and fixed in the new septum, which was surrounded on all sides by the chlorophyll-sacs.

Fig. 60 shows a somewhat more advanced stage of development: the new septum is here separated by the prolonged action of water containing carbonic acid, into two laminæ, the thickening of which had commenced, not from the whole periphery, but from one side. After the maceration of these cells in solution of chloride of calcium, the portions of the primary cells which were not yet thickened became much swelled, and acquired a deep violet-blue colour with iodine.

In the same specimens, as also in those cultivated with them, in which I detected, in this way, with perfect certainty, the multiplication of the joint-cells by endogenous cell-formation, I likewise frequently observed internal annular folds of the wall of the joint-cell, and with far greater distinctness than in the cases described in p. 125, as the folds here could be in general more readily distinguished, from their considerable thickness, which usually increases towards the central margin.

When this folding existed in the lowest degree, the non-nucleated daughter cells were developed in about the proportion shown in fig. 61; between them the wall of the secondary membrane of the joint-cell sank in, together with the unaltered and regularly adherent chlorophyll-sacs, so far as to form a fold of equal depth and breadth.

The other extreme of this fold-formation is represented in fig. 82, from a plant which had lain for some time in water containing carbonic acid; hence the thickening of the primary membrane of its joint-cells. The endogenous cells were here in complete apposition, forming a perfect septum. Squeezed in between them is a fold of the wall of the mother cell, which in this case did not grow regularly from the whole periphery into the cavity of the cell between the daughter cells, but only projected far into it in a part of its extent, whilst another portion of the circumference remained unaltered.

At this part, which was not affected by the folding, the chlorophyll-sacs, which were elongated simultaneously with the formation of the fold, are seen bent and crooked, as if they had been acted upon by a mechanical constriction. Others are separated into fragments, as in the normal formation of a septum. A joint-cell of this kind, seen from the side on which the fold is perfect, may readily be regarded as completely divided; and this illusion may be increased by the position of the new cell-nuclei, when, as in the case figured, they are large and filled with granular mucilaginous matter, situated in each of the new cells, not in the middle, as in the examples described at p. 125, but close to the new septum, and when seen in a particular direction appear like a cell-nucleus cut through by the fold.

It is rarely that, as in *Cladophora*, these folds appear to project freely to a greater or less distance into the cell-cavity; nevertheless I have repeatedly observed this on apparently perfectly healthy plants, especially of *S. orthospira*.

In diseased and dying plants, the joint-cells of which are often disproportionately short, the folds of the membrane are usually more developed, so that it would almost appear that the development of the two parts stands in a certain mutual relation.

These folds may be most readily seen when *Spirogyræ* are allowed to lie for a long time in water containing carbonic acid until all the endogenous cells of the joint-cells are destroyed. By the action of dilute endosmotic solutions, the membrane of the secondary cell then readily retracts itself, together with its still adherent chlorophyll-sacs, from the folded primary cell-membrane, producing appearances which would certainly appear well fitted to confirm the constriction-theory, if we were not undeceived by developmental history and analogy.

These folds, which occur in all degrees of breadth and difference of form, are, however, not destined to effect a multiplication of the joint-cells by the growing together of their central margin, any more than those of *Cladophora*, many of which

I observed unaltered for months together. This, unfortunately, cannot be done with *Spirogyræ*, some of which, however, I have been able to watch for several days before the death of the cell, without detecting any change of the fold.

For this reason it is quite inadmissible to regard the folds of the cell-membrane as abortive septa, at least as long as the production of such a septum by the amalgamation of the central margins of a true fold has not been demonstrated in a single instance, but, on the contrary, it has rather been observed that incompletely developed folds occur only as accompanying an endogenous cell-development taking place not altogether without disturbance, whilst in the normal development of the latter the newly formed septa are unmistakeably recognizable as endogenous productions.

[To be continued.]

XIV.—*Description of a Species of* Dolphin *found in the Orkney Islands.* By Alex. R. Duguid, M.D.

[Plate III.]

For many years I have heard the fishermen in this neighbourhood speak of a species of Whale, with white spots or stripes, which they frequently met with when in pursuit of the *Phocæna melas*, or Cāāing Whale. The facility with which the latter is driven on shore is well known: hence the specific name which has been applied to it by some naturalists—*deductor*. But of the capture of the former species, though frequently chased, I have never heard of an instance till recently.

On the 21st of August 1858, several fishermen were pursuing their avocation in Scapa Bay, near Kirkwall, when, a shoal of whales making its appearance, all the boats went in pursuit. On approaching the whales, they were discovered to be the spotted or streaked species; and some of the pursuers desisted from all further efforts, expressing their opinion, from past experience, that it would be of no use attempting to capture them. Some of the boats, however, persevered, and having succeeded in getting a part of the shoal nearer to the beach, all again resumed the chase with renewed and vigorous efforts, and at last landed twenty small whales, which were speedily put to death by means of fishermen's knives and other lethal weapons.

I saw the whales on the evening of their capture. I knew them to be of a species which I had never seen before; but it was too dark to make an examination of them. I saw them again on the 23rd of August, and, having selected a specimen which was the least injured by the knives of the captors, I shall

now describe it. The length of all the animals varied from 6 to 9 feet. Of this one, the length was 7 feet 2 inches, circumference 4 feet; length of dorsal fin 17 inches, and 8 inches high. From snout to dorsal fin 2 feet 9 inches. From dorsal fin to middle of tail 3 feet 4 inches. Tail 1 foot 8 inches broad, and cleft in the middle to the extent of 1 inch. Upper jaw 9 inches long, decidedly beaked for 3 inches; lower jaw $9\frac{1}{2}$ inches, projecting $\frac{1}{2}$ an inch beyond the upper. Pectoral fin, or swimmer, $12\frac{1}{2}$ inches long; base of it 15 inches from the extremity of the lower jaw. The eye oval, $\frac{8}{10}$ths of an inch in its longer diameter, and $\frac{1}{2}$ an inch in its shorter, situated in a horizontal line with the mouth; the pupil dark brown. Teeth in both jaws the same in number, 29 on each side, conical. When the mouth is shut, the teeth of one jaw fit into the interstices between the teeth of the other, like the teeth of a trap. Two double teeth in the upper jaw on both sides at the back; but this was not observed in other specimens. The colours and markings were precisely the same in all the specimens, without the smallest perceptible variation. The back was black, and the belly pure white, without grooves. There was a streak, of a dark yellow or clay-colour, commencing under the anterior part of the dorsal fin, and running nearly to the tail, nearly in the middle of the side, and about $3\frac{1}{2}$ inches in breadth. Another streak of dazzling white commences some distance behind the eye, running towards the tail, partly underlapping the yellow streak, but not extending so near to the tail. Under these there is a dusky streak, running all the way from the nose to the tail, with a very irregular outline. The white streak was from 4 to 5 inches broad. The blow-hole is crescentic in shape, with the convex side backwards. (Pate III.)

I am favoured by a friend with the following description of another specimen :—From tip of snout to the middle of the tail, along the back, 8 feet 3 inches; the same, in a straight line, 7 feet 8 inches. Tip of lower jaw to anterior of pectoral fin 1 foot 4 inches; from the same to the posterior of same 1 foot 9 inches; from the same to genital organs 4 feet 10 inches; from the same to anus 5 feet 9 inches. Distance between pectoral fins below, $6\frac{1}{2}$ inches; the same, above, 2 feet $9\frac{1}{2}$ inches. Length of pectoral fins, in curve, 1 foot $4\frac{1}{2}$ inches; length from centre of base to tip 1 foot 1 inch. Expansion of tail 2 feet 1 inch. Width of flaps of tail 9 inches. Length from snout to dorsal fin 3 feet 1 inch. Length of dorsal fin in curve 1 foot 7 inches; length of the same from centre of base to tip 1 foot 1 inch; breadth of the same at middle 7 inches, at base 1 foot $3\frac{1}{2}$ inches. Length of upper jaw, in a straight line, 10 inches; of lower jaw 11 inches. Girth, at dorsal fin, 4 feet $3\frac{1}{2}$ inches; at pectoral fin, 3 feet 10 inches; at anus, 3 feet; at 1 foot from

middle of tail, 1 foot; at 8 inches from tail, 6 inches. Girth of head at blow-hole 2 feet $6\frac{1}{2}$ inches. Tip of snout to blow-hole 1 foot $1\frac{1}{2}$ inch. Length of beak $2\frac{1}{2}$ inches. Height of dorsal fin 9 inches. These measurements were from a male. There is a dark mark around the eye, about $\frac{3}{4}$ of an inch broad. The eye is small, and the form of the pupil is crescentic, with the points upwards. The blow-hole is situated between the eyes; its form is crescentic, the concave side being forward, and there is a slight depression around the blow-hole. An auditory meatus is present (not to be found in several) above and rather behind the eye, and over the anterior portion of the pectoral fin. Its opening would admit a No. 1 shot. The head is sharp and beaked; the lower jaw a little longer than the upper. The number of teeth is $\frac{29}{32}\frac{29}{32}$; they are largest in the middle of the jaw, and gradually diminish in size towards each end, those at the anterior extremities of each jaw being the smallest. There are no teeth at the symphysis of either jaw for the space of nearly an inch. In form they are conical, being slightly incurved at the back, and nearly straight in front; those in the lower jaw are most incurved. While the teeth in the upper jaw point forwards, those in the lower jaw point backwards; so that when the mouth is shut, they lock into each other very closely, and the points of the teeth are lodged in little fossæ in both jaws: these fossæ appear to be only in the membrane of the gum. The palate is smooth and spotted. The tongue is not free, but, the frænum being large, it admits of great movement; it is black at the centre, and white at the margins. At the symphysis of the lower jaw the lip turns upwards, and has two slight elevations, which fit into two corresponding notches in the upper lip. There is a regular prolabium in the upper lip, so as to give it a pointed appearance. The colour of the back is jet black. There is a long streak towards the tail, of a dirty yellowish colour. About the middle of each side there is a very conspicuous oblong white streak, under which the sides are dusky. The belly is of a beautiful clear white. The pectoral and dorsal fins are black. The tail is black, with a very little white underneath.

From this animal being shortly but decidedly beaked, I assume that it belongs to the genus *Delphinus*; but I can find no description of a species in the works of Bell, Fleming, and Jardine which agrees with it. It seems to come nearer to the description of the *Delphinus Tursio* of Fabricius than to any other; but I have no doubt it will be found to be different. The symmetry of its form, and more particularly the great beauty of the colours, when contrasted with each other, with the streaks and

markings exactly alike in every individual of the shoal, would indicate with tolerable certainty that it had never been observed before; for, had it been otherwise, these peculiarities, being so very striking, could not possibly have been overlooked. But this I leave to more profound naturalists to determine.

Kirkwall.

[There is little doubt that this Dolphin is *Lagenorhynchus leucopleurus* of my Catalogue of Cetacean Animals in the British Museum, published in 1850, p. 97, which Mr. Knox (under the name of *Delphinus Tursio*) describes as found at the Orkneys in May 1835. The skeleton of this specimen is in the Museum of the University of Edinburgh.—J. E. Gray.]

XV.—*On a new British Species of* Rissoa. By E. Waller, Esq.

To the Editors of the Annals of Natural History.

Gentlemen,

Having accompanied my friend Mr. Jeffreys in several of his late excursions to the Shetland Islands, I have had the opportunity of seeing, on their first capture, many of the novelties added to our fauna in those distant and difficult dredgings. I know his unwillingness to anticipate the interest properly reserved for his 'British Conchology,' now in course of publication, by a previous description of any of the new shells; but I am tempted to infringe, with his permission, on this rule in one instance. In the home examination of sand obtained to the north of the Island of Unst, at a depth of 85 fathoms, I found a *Rissoa* which appears to have been hitherto undescribed and unnamed. I wish to couple with it the name of Mr. Jeffreys, whose persevering and long-continued labours have added so largely to our knowledge of British conchology. I would therefore feel obliged by your publishing in the 'Annals' the following description of *Rissoa Jeffreysi*, one of the novelties announced in the Report to the British Association (1863) on the Shetland dredgings.

I remain, Gentlemen,
Your obedient Servant,
Edward Waller.

Lissenderry, Aughnacloy,
June 29, 1864.

Rissoa Jeffreysi, n. sp.

Shell conical, moderately strong, somewhat glossy and semitransparent.

Colour white.

Whorls 5–6, sloping from the suture to the second ridge, and well rounded thence to the lower suture; the last whorl exceeding half the length of the shell, and obliquely rounded at the base.

Sculpture: on the penultimate whorl four rather slender but well-defined spiral ridges, the lower three of which are stronger than the highest one, which is on the upper slope of the whorl. The ridges are crossed by about twenty-eight perpendicular ribs, not so much elevated nor nearly so strong as the ridges, and forming with them square cancellations, the intersections of the ridges and ribs being scarcely raised, but slightly nodulous. The apical whorls are marked with spiral rows of close angular punctures. In each succeeding row the punctures lie below the ridges separating those of the preceding row. The base of the lowest whorl has 5–7 spiral ridges, for the most part uncrossed by the ribs, which generally terminate at the line of the upper part of the mouth.

Suture deeply defined and somewhat excavated.

Mouth roundish oval.

Outer lip smooth inside, and strengthened outside by a broad and strong rib.

Inner lip smooth and reflected on the pillar, making the peristome continuous.

Umbilical chink very small.

Length 0·10 inch, breadth 0·07 inch.

Its nearest ally is *Rissoa cimicoides*, Forbes (*Rissoa sculpta* of F. & H., but not of Philippi); but it differs from that species in being of smaller size and of thinner texture, in having the whorls more rounded and with a rapid slope from the deep suture to the second rib. The general outline is decidedly less conical; and while the longitudinal ribs are much the stronger in *R. cimicoides*, the transverse ones are stronger in *R. Jeffreysi*, and the nodules at the intersections are much larger in the former than in the latter shell. In the present species the sculpture is infinitely more delicate than in its ally. The throat is crenulated in *R. cimicoides*, but smooth in *R. Jeffreysi*. *R. cimicoides* is yellow, with purplish-brown blotches; *R. Jeffreysi* is porcelain-white.

Its habitat is in sandy ground, in from 80 to 85 fathoms; and it has been taken in two localities at about eight miles and thirty miles from Unst, the most northern of the Shetland Islands.

Mr. Jeffreys informs me that, when in Scandinavia, last year, he saw two or three specimens in the Museum at Upsala, col-

lected by Professor Lilljeborg on the coast of Norway, and about the same number at Stockholm, taken by Professor Lovén on the same coast. In both cases those shells were separated, as distinct from described species, but not named. Reference being made to Mr. Jeffreys, he recognized them, and mentioned my intention of describing the species and naming it after him.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Nov. 10, 1863.—E. W. H. Holdsworth, Esq., F.Z.S., in the Chair.

Remarks on the Exhibition of a Natural Mummy of Alca impennis. By Alfred Newton, M.A., F.L.S., F.Z.S.

For the last twenty-one years, since the appearance of the part of Mr. Yarrell's 'History of British Birds' containing his account of *Alca impennis*, wherein was cited M. Audubon's statement that that species bred on an island in the neighbourhood of Newfoundland, the attention of ornithologists in this country has been more or less directed to that colony, in the hope of obtaining thence specimens of this rare and curious bird. Mr. John Wolley, with his usual sagacity, applying the knowledge he had culled from his extensive researches among the works of our older naturalists, not only soon made out the truth of Willughby's supposition, "Penguin *nautis nostratibus dicta, quæ* Goifugel *Hoieri esse videtur*" (Ornithologia, Lond. 1676, p. 242), but found that the name was still persistent among those who were yet engaged in the Cod-fishery in the Newfoundland seas. Among his various memoranda I find one, apparently written about the year 1850, to this effect:—

"In Newfoundland, Funk or Penguin Isle is 170 miles north of St. John's, and about thirty-six miles north-east by east from Cape Freels, the north headland of Bonavista Bay. There are also Penguin Isles two or three miles from shore; Penguin Islands, too, in the middle of the south coast of Newfoundland."

This note was evidently written after making a careful examination of the map; and I well remember, in February 1856, going over a chart of the North Atlantic with him, in which he had previously marked the various places known as "Penguin Island," "Bird Rock," and the like. To the best of my recollection, he also told me, either at the same or some former period, that in the course of his reading he had come across various notices of "Penguins," contained in the narratives of ancient voyages to that part of the world. All this time, however, I had not been altogether idle in the way of collecting (or at least seeking for) information on the subject. In the summer of 1853, as I have elsewhere stated*, a boatman at Torquay, then about seventy years of age, and by name William Stabb, told my

* 'Zoology of Ancient Europe,' London and Cambridge, 1862, p. 30.

brother Edward and myself that in former days he used to follow the Newfoundland Cod-fishery, and that he had seen Penguins off that coast. He added that they used to resort by hundreds to some islands there to breed, but were destroyed for their feathers, being driven up in a corner by people in boats. This practice, however, must have nearly or altogether ceased in his time; for he stated that he had never seen but two or three birds himself, and never a dead one. I mention these facts merely to show that Mr. Wolley's determination to work out the history of the Gare-Fowl, or Northern Penguin, was formed prior to his acquaintance with Professor Steenstrup's valuable discoveries, and to their publication in the elaborate and excellent article (Vidensk. Meddelelser, 1855, pp. 33-116) on this bird to which it always gives me so much pleasure to refer. When Mr. Wolley, later (in 1856), became aware of what that illustrious naturalist had ascertained, he was more than ever bent upon prosecuting his researches; and, acting upon the information I received from him, I at once set about doing what I could to further them*. Believing at the time that no example of the bird's skeleton existed in any of the European museums, and having great confidence in the trustworthiness of Herr Stuvitz's statements, as given by Professor Steenstrup (*loc. cit.*), that there were still many of its bones to be found on Funk Island, I began to address letters of inquiry respecting them to almost every one I could hear of in Newfoundland who seemed likely to be able to give assistance. I need not here go into details. For a long time I could get no response from any of those to whom I wrote; some of my epistles were returned to me through the dead-letter office; and occasionally I almost despaired of calling attention to the subject in that colony. At last I had the great pleasure of receiving from the clergyman of the Island of Fogo, the Rev. Reginald M. Johnson, a reply which in the most obliging terms promised me his valuable help in the matter. Still the chances of procuring specimens of bones that would really be serviceable towards determining the osteology of *Alca impennis* were not good. Though when Stuvitz, in 1841, visited Funk Island the bones were in quantities (*i Mængde*), many causes during the time that had since elapsed might have scattered or destroyed them. The locality, as I have before shown, was a distant one and, like all resorts of the Gare-Fowl as far as I know them, not easy of access. Stuvitz stated there were but two landing-places, and these only to be attained by a hazardous leap (*kun ved et voveligt Spring*). These latter particulars were confirmed by Mr. Johnson; and in the last letter which I had from that gentleman (only a few weeks ago) he told me he had come to the gallant determination to make the expedition himself, as without him he was sure all endeavours to obtain the bones would fail. Meanwhile the Bishop of Newfoundland, in the course of one of his visitations, had been shown by Mr. Johnson my letters, enclosing sketches of the principal bones and other papers relating to the subject, and most kindly volunteered to give me all the aid in the matter which his high position afforded. When the members of

* Cf. 'The Ibis,' 1861, p. 397.

this Society know the result, I think they will congratulate me on my good fortune in having excited his lordship's interest. After several other friendly letters, I had three days ago the great pleasure of receiving one in which the Bishop informed me his success had surpassed anything I could have anticipated; for his lordship had done no less than secure me what may be not inaptly called the "mummy" of an *Alca impennis*, which, having come into my hands yesterday, I have now the honour of exhibiting to the Society.

It appears that the Colonial Government have recently conceded to a Mr. Glindon the privilege of removing the soil from Funk Island; for this soil, being highly charged with organic matter, is consequently valuable as manure when imported to Boston and other places in North America. The Bishop, through Mr. N. R. Vail (a gentleman of the United States, well informed on scientific subjects, and therefore aware of the interesting nature of the research), made application to the lessee of Funk Island, who ordered his men employed there to use their best endeavours to obtain for me bones of the Penguin. They appear to have done their work very effectually; for I hear that they "brought away many puncheons of bones and other remains"—of course not all necessarily "Penguins"—which I believe are now on their way to New England, where they will doubtless be readily bought up by the farmers, though I trust some may be rescued from ignoble uses by the American naturalists. This mummy, however, the Bishop tells me, was "found four feet below the surface, and under two feet of ice." I need scarcely point out to the Society what an advantage it is to have obtained so many bones undeniably belonging to one individual bird. Though the skeleton is not perfect, it is plain that we have here at least one side of the entire vertebral column. The extremities of the limbs are altogether wanting on either side; and though this is greatly to be regretted, it is some consolation to think that a knowledge of what these parts are like in *Alca impennis* may be, with a little trouble, supplied from almost every one of the sixty-three or sixty-four stuffed skins at present known to exist*. I do not, however, mean to prolong these remarks by making any observations on the osteological structure of this bird. That I have reason to hope may be fully described by a far more able pen; for it is my intention to place the specimen I now exhibit in the hands of Professor Owen, trusting that he will make it the subject of one of those monographs which have so materially enriched our series of 'Transactions.' I have but to say in conclusion that, so far as I know, my "mummy" is, with one exception, the only approach to a complete skeleton existing in Europe. That exception is the specimen, nearly perfect, in the

* Mr. Blyth, just six and twenty years ago, exhibited to this Society some bones which had been left in a preserved skin of this bird (P. Z. S. 1837, p. 122; and Ibis, 1861, p. 396, *note*). Within the last year, Mr. John Hancock extracted from his own beautiful specimen, and from the very ancient and interesting example in the Newcastle Museum, *every bone* they contained, without doing the slightest damage to the skins, as might be seen at the late Meeting of the British Association (*Cat. of Exhibition*, nos. 180 & 185).

Osteological Gallery of the Museum of the Jardin des Plantes at Paris; for the remains of the two Gare-Fowls killed on Eldey in 1844, which were sent to Copenhagen, and are still preserved in the Physiological Museum of the University there, have been dissected with a view to show the different systems of organs; they are therefore even less available to determine the general osteology of the bird than are the various loose bones which, through Stuvitz's labours, exist in the Museums at Christiania and Copenhagen, that of our Royal College of Surgeons, and in my own collection.

Nov. 24, 1863.—John Gould, Esq., F.R.S., in the Chair.

The Secretary read the following letter from Dr. J. Shortt, F.Z.S., relating to the fishing-propensities of the *Pteropus* of India:—

"Sir,—At about 6 p.m. on the 30th of April last, when at Conleeveram, my attention was attracted to a tank next the Dispensary, which, owing to a light shower of rain that had just fallen, literally seemed alive with small fish gambolling and jumping about in the water. There was nothing new in this; but my attention was drawn to a number of large birds with a somewhat heavy flight, hovering over the water and seizing with their feet the fish, with which they then made off to some tamarind-trees on the bund of the tank, to devour them at their leisure, I suppose.

"On a closer examination, I discovered that what I had imagined mere birds were none other than Flying Foxes, the *Pteropus edulis*. After watching them fishing for some time, I had to leave, owing to the darkness of the evening. I returned to the tank the next evening half an hour earlier, and again witnessed the same occurrence.

"I then got my assistant, Mr. Watson, to bring his gun and shoot some, so that I might satisfy myself as to the identity of these animals. Mr. Watson shot some two or three whilst in the act of seizing their fishy prey, and on examination I found them to be actually Flying Foxes. During a second visit, on the 5th and 6th of June, I observed the same thing occur again.

"I am not aware of the fishing-propensities of this animal ever having been noticed, for I find no account of them in any work on natural history that I have had opportunities of consulting on the subject. This habit of the Flying Fox appearing new to me, I send you this communication, as there may be others who have witnessed the same thing; and if made known, this would, I am sure, prove of interest to the naturalist.

"Chingleput, June 12th, 1863."

The Secretary also read the following extract from Dr. Bennett's latest letter (dated Sydney, Sept. 19th), respecting the Kagu of New Caledonia (*Rhinochetus jubatus*):—

"My young friend Mr. Ferdinand Joubert thus writes to me from 'Kai,' in the interior of New Caledonia, August 2nd, 1863:—

"'I see in the 'Sydney Herald' your article on the Kagu. I will

send you some of the birds as soon as I can procure them, and also some nests and eggs, if pipes and tobacco can induce the natives to bring me some. The Kagus are rather plentiful here, on the side of the "Boh" Mountains, and the natives catch them to eat. Their way of doing this is by making a slipknot on a strong string; and having discovered a place frequented by these birds, they fasten the string in such a way that the birds when running along pass their heads or legs through the noose and are thereby captured. There are two kinds of Kagus, one very different from the other. The largest Kagu you last received from Dr. Segol is a female of the "Bush-Kagu," and, as you have remarked, much handsomer than its fierce friend the smaller Kagu, which is the one with the dark stripes on the wings and tail (and generally of darker plumage). This is the "Grass-Kagu." These two kinds of Kagu do not associate together on good terms; and during the time I had them they were always fighting one with the other, the "Grass-Kagu" invariably getting the worst of the battle.

"'I will endeavour to procure a male and female of each species, and send them to you as soon as I can.'

"This fighting-propensity may in some degree account for the death of the little pugnacious Grass-Kagu soon after its arrival. It was found in a miserable half-starved condition when dissected; whilst the larger, elegant, and more peaceful 'Bush-Kagu' was in fine plumage, plump, and altogether in a healthy state, which continues to the present day.

"I have since written to Mr. F. Joubert, requesting him to send me as soon as possible a pair of skins of each species, male and female, properly labelled, and living specimens in pairs, as soon after as they can be procured, when I will transmit them to you immediately, so as to decide this interesting doubt on the subject of the existence of two species of this singular bird."

Description of a New Species of Flexible Coral belonging to the Genus Juncella, obtained at Madeira. By James Yate Johnson, Corr. Mem. Z.S.

Fam. Gorgonidæ.

Sect. Gorgonellaceæ, Val.

Juncella flagellum, sp. nov.

Simple, elongated, slender, flexible, slightly twisted on its own axis, and tapering upwards. Bark calcareous, white, smooth, and impuncturate, enveloping a hard grey axis, which has a somewhat polished surface marked with straight striæ. This axis is so highly charged with carbonate of lime that it effervesces in muriatic acid. The coral is quadrangular in section, and has on each of the two narrower sides two series of closely set papillæ, having the eight lobed orifices of polype-cells at their apices. These papillæ are obpyriform or ovate; and in dried specimens they are turned upwards

and adpressed to the stem. Near the base of large specimens the papillæ are in three somewhat irregular rows. The other two sides of the stem are free from papillæ, but there is a slightly elevated line along the middle. The base spreads out to a moderate extent upon the object to which it is attached. The spicula, of which the bark is composed, are tuberculated staves two or three times as long as broad, the tubercles having a tendency to collect at the extremities.

The longest example of this coral which I have seen, measured about 7 feet in length; and it was without its basal portion. The greatest thickness was three eighths of an inch; the largest papillæ were the tenth of an inch in length, and about the same across. In another example, 5 feet in length, the base spread out to the size of a shilling; and the papillæ commenced about 3 inches above this basal expansion. The smallest specimen that has occurred was 31 inches long; and this has been sent to the British Museum. In the collection of that establishment there is a large stone with numerous specimens of this coral upon it, alongside examples of *Callogorgia verticillaris*, Gray (*Primnoa verticillaris*, M.-Edw.). These were brought from St. Michael's, one of the Azores, and presented to the Museum by Mr. McAndrew.

I have ventured to assign this coral to the genus *Juncella*, Val., although a naturalist for whom I entertain the highest respect considers it to be the *Scirpearia mirabilis* of Cuvier. There is, however, so much doubt as to what the coral so named by the illustrious Frenchman really is, that I hesitate to ascribe mine to that species, the more especially as it clearly falls within the definition of the genus *Juncella* (as it appears in the 'Histoire Naturelle des Coralliaires' of Milne-Edwards, vol. i. p. 186), forming a member of the section of *Gorgonellaceæ* which is made up of Gorgoniad corals having a smooth bark and a sublithoid axis containing so much carbonate of lime as to effervesce in muriatic acid. From *Juncella juncea*, Esper, and *J. vimea*, Val. (species found at the island of Bourbon), it would seem to be distinguished by the large size of the cup-bearing papillæ; from *J. elongata*, a Mediterranean species, by its being simple, not branched. *J. hystrix*, *J. surculus*, and *J. caliculata* appear to be names without descriptions.

As to the difficulty of identifying *Scirpearia*, the following passage from M. Milne-Edwards's work, already referred to, may be quoted:—

"The Alcyonarian described and figured by Linnæus under the name of *Pennatula mirabilis* seems to be very little connected with *Virgularia mirabilis* as some have suggested. It has a slender stem, attenuated at the two extremities, and bearing at each side a simple series of widely separated polypes. Cuvier formed of it the genus *Scirpearia*, which has been adopted by Ehrenberg. Lamarck placed it in his genus *Funiculina*, near *Pavonaria*, under the name of *F. cylindrica*. Fleming thought that the species was not distinct from *Virgularia*; and Blainville affirmed that it was nothing but a *Gorgonia*. None of these opinions seem to me admissible. It is too imperfectly known to have a place assigned to it in a scientific classification of corals."—*Hist. Nat. Corall.* i. p. 214.

Dec. 8, 1863.—E. W. H. Holdsworth, Esq., F.Z.S., in the Chair.

On the Systematic Position of the Crested Screamer (*Palamedea chavaria*). By W. K. Parker.

Many years ago, at a time when the only collection of foreign living creatures seen by me was contained in Wombwell's travelling menagerie, my observations on the structure of birds were necessarily confined, for the most part, to our native species. I am glad of this now, as they are nearly all of *pure* types; and from childhood their life and conversation yielded me a pleasure nearly equal to that derived from communion with bipeds of the plumeless kind.

If the structure of the pure or unmixed types had not been studied by me first in such a way as to make the most definite mind-images, there would have been for me no good firm ground to stand upon whilst contemplating the structure and relationships of such birds as the Trumpeter (*Psophia*), the Cariama (*Dicholophus*), and the *Palamedea*. Any study, however, of the Bird class which should go no further than its own border-line would be fruitful in bringing to light difficulties and even paradoxes: a physiologist might as well study the functions of one class of organs to the total neglect of the rest of the body, the beautiful *whole*. I have for some time past held to the belief that the birds should not be termed a class, as though they formed a group *equal* to that of the Mammalia; I find that Professor Huxley holds the same views.

If that is the case, we have some explanation of the great uniformity of the feathered tribes; for it is a fact that the remotest forms in the group are really not far apart in nature, and the smaller groups are closely intertwined one amongst another.

There are two principal conditions of nearness to the Reptilia in the great Bird group: first the combination of mammalian and of reptilian characters with what is truly ornithic, as in the Ostriches; and the second is when the aberrant characters are only reptilian, and for the most part *lacertian**.

Now it is with *lacertian* characters, rather than with what we find in the Crocodile and the Chelonian, that we have to deal in such birds as the *Palamedea* and other mixed forms which are not far from it in actual nature, but are striving, as it were, to attain to the full typicalness of other groups than that to which the *Palamedea* really belongs.

The discovery of such a marvellous creature as Von Meyer's *Archæopteryx* must of necessity give the scientific mind a thirsty longing to know more of the relations, and of the true causes of the relations, of these mid vertebrates, the reptiles and birds,—cold-blooded, scaly, slow, and often loathsome on one hand; on the other warm, intensely active, and endued with the highest locomotive powers, and beautiful beyond the power of words to express.

There are two very beautiful groups of birds, rich in species, with very clearly defined characters, both standing at about the same

* The skull of every bird known conforms, on the whole, not so much to the *crocodilian* as to the *lacertian* type; their horny jaw-sheaths, large symmetrical sternum, and almost fixed ribs are *chelonian* in their nature.

"ornithic" height above the Ostriches, and in a very similar contiguity to the Lizards: these are the true "Gallinæ" and the true "Anatinæ." In the latter family we have all the birds from the Spur-winged Goose (*Plectropterus*) to the Goosander, inclusive; in the former, the "Phasianinæ" and the "Tetraoninæ"—the typical and subtypical Fowls. The Flamingo is truly *lamellirostral*; but its anatine characters are confused and mixed up with those that are derived from the Ibis and the Crane. Again, in the Fowls, we have carefully to keep the "Cracinæ," the "Hemipodiinæ," the "Megapodiinæ," and the "Pteroclinæ" in separate circles, because the *woof* of their nature is one thing, and the *warp* another; they are not zoologically *pure*, not *wholly* Gallinaceous. The parts first formed in the embryonic skull—those which are most central, and least and most slowly affected by the causes that fit each creature for its place and work in nature—these are strangely alike in both the "Sifters" and the "Scrapers"; and for a long while this fact has been a mystery and almost a paradox to me. I care very little for the webs between the toes; their absence or presence may suffice to separate between *genus* and *genus*, but not between *family* and *family*, still less between *order* and *order*.

The water-birds may, however, be divided very easily into two groups by the presence or absence of two very curious membranous spaces appearing in the occipital plane. These *fontanelles* separate the auditory from the superoccipital cartilage,—and are scarcely open at all in the true "Ardeinæ," the "Rallinæ," the "Podicipinæ," and the "Pelecaninæ"; nor do they appear in the Land and Tree groups of birds.

In the "Ibidinæ," the "Lamellirostres," the Gruine, Pluvialine, and Tringine groups, they are large and persistent; in the "Larinæ" they soon fill up with bone, and so they do in *Œdicnemus*, and apparently in the Bustards. Now the great embryological distinctions between the skull and face of the Geese and Fowls are, first, that in the latter the space between the periotic mass and the superoccipital cartilage is a mere chink, in the latter a persistent oval space; and secondly that the anterior parts of the face, viz. the præmaxillæ, prevomers, and dentaries are small and compressed in the Fowls, large and outspread in the sifting birds. The body of the tongue partakes of the general expansion of the face in the Geese; the descending part of the lachrymal suffers from the general contraction of the parts in the face of the Fowl. Moreover the true Fowls ("Phasianinæ" and "Tetraoninæ") have the head of the os quadratum less bifid at its joint with the skull, and therefore nearer the Ostriches and reptiles in its structure than the same bone in the Goose-tribe. It is highly worthy of remark, however, that the Sand-Grouse, *Hemipodii*, Megapodes, and Curassows all agree with the Geese and their allies in having a subornithic condition of this famous bone; and its upper articular crura begin to be quite distinct representatives of the legs of the mammalian "incus." This, be it noticed, makes the four groups of mixed "Gallinæ" correspond, not only with the Lamellirostres, but also with all those puzzling border-birds which

must be studied in connexion; such as *Psophia, Parra, Cariama,* and *Palamedea.*

Now the Rail-tribe, to which *Palamedea* has been supposed to belong, has been for a long time burdened (on paper) with a very false army-list. Everything alive that has had the misfortune to be possessed of large unwieldy feet has been added to this feeble-minded, cowardly group, until it has become a mixed multitude, with discordant voices, and with manners and customs having no consonance or relation. In a former paper I had the assurance to disband the Cassowaries and Megapodes; in the present I shall permit all birds having much of the nature of the Plover (such as *Parra*), and all those which have in them the nature of a Goose, to depart from the Rail-tribe: I shall retain the *Psophia* as an outpost, notwithstanding that it is more than half a Crane.

A very large number of the genera of birds partake of a structure and nature which may very appropriately be called Passerine; and another very large group, both of genera and families, may also be called Pluvialine,—the common Golden, Grey, and Dotterel Plovers being typical of these groups, which run up through the Sandpipers and Curlews to the Ibises in one direction, through the Lapwing and Stone-Plover to the Bustards and Cranes in another, and through *Chionis* and the Pratincole to the Petrels and Gulls. Still this does not exhaust the pluvialine birds; for the Geese and their allies are related on one hand to the Ibises through the Flamingo, and on the other to the Cranes, although the proper connecting link in this case is doubtful, *Palamedea* lying obliquely, not directly, between them. The Megapodes, Hemipodes, Sand-Grouse, and Tinamous also have no little proportion of the Plover in their nature. The Jacanas (*Parra*) are essentially Plovers, although they have something of the Rail in them, especially in their skull; and they are united to the typical forms by other Spur-winged Plovers (*Pluvianus spinosus*, Gould). Now, looking at the anatine birds as a great division of specialized forms parallel with, and intimately related to, the pluvialine birds, we begin to see how they can be related to the mixed "Gallinaceæ," which have so much of the Plover in their essence. But we had much, at starting, in common between the typical and pure Fowls and the Duck and Goose tribe; add to this the fact that the Mound-makers and Curassows come much nearer to the "Anatinæ," and then suppose an anatine bird in which the horny denticles are feeble, but abundant, and the jaws compressed, stout, and trenchant, the same bird having the occipital region in harmony, not with the Geese, but with the Fowls,—put all these things together, and we shall be supposing what really exists in the *Palamedea*. Then we can calmly look at the fact that those Geese which have spurs in their wings, like those of the *Palamedea* (viz. *Chenalopex* and *Plectropterus*), have their legs longer, more grallatorial, and better under them than the typical forms, and that the Spur-winged Goose (*Plectropterus*) has a pelvis exactly intermediate between that of a typical Goose and that of a *Palamedea*. It is worth while to notice the thick down that covers the *Palamedea*, the height of the bare tract on the tibia, and the reti-

culated tarsi, like those of the Goose, and not like those of the Cranes and Rails, which have them scutellate in front. Whilst removing the viscera, I saw that the trachea and inferior larynx were truly anserine; for there are no inferior laryngeal muscles, the contractors of the trachea ending one-third of an inch above the bifurcation, and only a delicate fan-shaped fascia going to the half-rings. Moreover the trachea itself, from being flat and cartilaginous, becomes round and then compressed and osseous an inch above the bronchi, so that it cannot be mistaken for the trachea of any other than an anatine bird. There is nothing whatever in the digestive organs, which are extremely voluminous, to separate the bird from the Geese; yet the gizzard is not so strong as in the types, and the cæca coli are shorter and wider. I have at present only hinted at the osteology of the *Palamedea*. It diverges from the Goose in all this part of its composition, just as much as it converges towards the Curassow and the *Talegalla*; but it is not only more galline than the true Geese (we have seen that both Geese and Fowls have much in common), it is also plainly more *lacertine*. It will require a goodly memoir to do it justice; but in this short notice I must mention one or two things. Its *large soft* tongue, which has not the papillæ horny, has in it the cerato-hyals, ossified from separate points as in the Goose and Hen, much nearer the former than the latter; but the free thyro-hyals are flattened from above downwards, and cannot be mistaken for those of any other but an anserine or anatine bird. All the skull and face, except at the two ends, conform to the lamellirostral type. Point by point, process by process, lamina for lamina, all else is truly and distinctly that which belongs to the Sifter, and to no other bird. It may be said indeed that this bird is not a Sifter; it is, however, a browzer and a *grazer*; and being of Lincolnshire descent, and familiar with the fens, I am well acquainted with the grazing habits of the typical Goose*. There is a little of the Crane in the sternum; but, on the whole, the skeleton may be said to belong to a very *lacertian* Goose. This is cautiously said; for have we not four fore claws in the wing, extremely long sprawling toes, and the ribs perfectly destitute of the nearly universal tie-bones or appendages? This deficiency is unique amongst birds; and the Crocodiles possess these appendages: I consider this a *lacertian* character, as their occasional presence in Lizards is as exceptional as their absence in birds. Now amongst the rib-like bones in the fossil skeleton of the *Archæopteryx* I see nothing like an appendage starting from any one of them; nor has Professor Owen figured anything of the kind in his beautiful memoir in the 'Philosophical Transactions.' Let it be added that, although several genera of birds have spurs to their wings, these birds all lie nearly on the *same ornithic plane* as the *Palamedea*, —the Syrian Blackbird (*Merula dactyloptera*) (see Professor Owen on *Archæopteryx*, p. 39) being the only exception. The Megapode is also mentioned by Professor Owen (*ibid.*); but that is a great help to me, and comes in well.

* "——— the cackling goose,
Close-grazer ———."—*Philips's Cyder.*

So we see that the birds with nails in their wings are (with one or two exceptions) all aquatic types, the more unspecialized forms of which are for the most part possessed of dorsal vertebræ conjoined by a cup-and-ball (opisthocœlian) articulation, and are very far below the typical tree-birds in their structure and in their habits.

But the digit-claws appear in other birds which have not outstanding spurs. Professor Owen (*ibid.* p. 39) mentions the *Apteryx* has having the mid digit terminating in a joint, which supports a curved claw; the Emeu and the Cassowary have the same structure; and the *Rhea* has an ungual phalanx covered with a claw added to the index-finger, which is generally composed of one joint in birds. The Swan, as well as the Chaja (*Palamedea*), have the same, and they both have the mid-finger series complete, the last joint being most perfect in the Swan (*Cygnus olor*). The furculum of the *Palamedea* is more like that of that great pluvialine the Bustard (*Otis tarda*) than that of a Goose; but it is very much more solid: its only counterpart for relative size is that of the *Archæopteryx*. The coracoids are strong bony tubes, open below by a large scooped hollow. The sternum of this bird differs from that of the Goose or Swan by just so much as the sternum of the Short-winged Rails, especially *Brachypteryx*, differs from that of the ordinary types. It is narrower behind, and the episternum is gone from the front: yet it is thoroughly anserine in character, for the keel does not reach the end; and, indeed, it is in this respect intermediate between what we see in the Geese and what occurs in the "Totipalmatæ." Eight ribs reach the sternum by hæmapophyses, as in the Swan; there are seven in the Goose, *Psophia*, and Serass Crane. On the right side there are a pair of floating hæmapophyses (reptilian), and these answer to the fourth and fifth so-called sacral vertebræ. In the Swan these hæmapophyses are better developed, and the penultimate has a long rib reaching it from the sacrum on both sides. And this brings me to say that the sacrum in birds, although actually of great length, has superadded to it a number of dorso-lumbar vertebræ in front, and often several true caudals behind.

Professor Owen (*ibid.* pl. 3. fig. 5) makes the first postfemoral joint in the young Ostrich to be the first true caudal. I cannot agree with him here; for I think that the sacrum in birds is long as a *prolepsis* of that of the mammal, but that it is an exaggeration of the mammalian sacrum. In the *Archæopteryx* there are four vertebræ behind the acetabula before we come to those marked caudal by Professor Owen (*ibid.* pl. 4. fig. 1 *c, d*). This has led me to run over the birds' pelves in my own collection and drawings; and the following table, which gives the number of vertebræ, closely embraced and tied together by the extension backwards of the iliac bones behind the acetabula, in different birds, is the result of my observations. I shall remark upon the bearings of these facts afterwards.

TABLE.

Birds built on the Passerine type.	Corvus frugilegus	4
	Gymnorhina tibicen	4
	Turdus merula	4
	Estrelda phaëton	3
	Pyrrhula vulgaris	4
	Emberiza citrinella	4
	Linaria chloris	4
	Pyranga rubra	4
	Loxia cardinalis	4
	Muscicapa grisola	3
	Budytes Raii	4
	Pratincola rubetra	4
	Motacilla Yarrellii	4
	Sylvia cinerea	4
	Phyllopneuste trochilus	4
	Parus ater	4
	Hirundo urbica	4
	—— rustica	4
	Sitta europæa	4
	Lanius collurio	4
Caprimulginæ.	Cypselus apus	4
	Podargus humeralis	4
	Caprimulgus europæus	3
Alcedinidæ.	Alcedo ispida	5
	Upupa epops	4
	Dacelo giganteus	4
Trochilidæ.	Trochilus colibris	3
Bucerinæ.	Buceros ruficollis	6
Zygodactyles.	Cuculus canorus	3
	Picus viridis	4
	Corythaix Buffoni	4
	Ramphastos toco	6
	Agapornis pullaria	4
	Psephotis multicolor	4
	Psittacus erythacus	4
Accipitres diurnæ.	Falco peregrinus	3
	—— æsalon	3
	—— tinnunculus	3
	Accipiter nisus	3
	Buteo vulgaris	3
	Milvus regalis	3
	Circus cyaneus	3
	—— cineraceus	3
	Elanus melanopterus	4
	Aquila chrysaëtos	5
	Haliaëtus albicilla	5
	Dicholophus cristatus	5
Vulturinæ.	Neophron percnopterus	5
Accipitres nocturnæ.	Ulula aluco	3
	Strix flammea	3
	Asio otus	3
	Athene noctua	3
Pigeons.	Columba livia	5
	—— palumbus	5
Cracinæ.	Oreophasis Derbyanus	5
	Crax globicera	5
Phasianinæ.	Dendrortyx	6
	Gallus domesticus	5
Tetraoninæ.	Lagopus scoticus	4
Hemipodiinæ.	Hemipodius varius	5
Pteroclinæ.	Syrrhaptes paradoxus	6
Megapods.	Talegalla Lathami	5
Rallinæ.	Crex pratensis	3
	Ocydromus australis	4
	Gallinula chloropus	4
	Fulica atra	5
Ardeinæ.	Botaurus minutus	4
	Ardea cinerea	4
	—— purpurea	4
	Herodias garzetta	4
	Nycticorax ardeola	4
	Tigrisoma leucolophum	4
	Eurypyga helias	3
	Cancroma cochlearia	5
	Balæniceps rex	5
Ibidinæ.	Leptoptilus argala	4
	Scopus umbretta	4
	Threskiornis æthiopicus	5
	Platalea leucorodia	6
Anatinæ.	Phœnicopterus antiquorum	5
	Palamedea chavaria	4
	Plectropterus gambensis*	7
	Anser palustris	9
	Cygnus olor	11
	Dafila caudacuta	7
	Anas boschas	8
	Mergus albellus	8
Gruinæ.	Psophia crepitans	4
Otinæ.	Otis tarda	5
Plovers.	Œdicnemus crepitans	5
	Vanellus cristatus	4
	Charadrius hiaticula	3
Long-billed Plovers.	Hæmatopus ostralegus	4
	Himantopus melanopterus	4
	Numenius arquata	5
	Totanus fuscus	4
Snipes.	Scolopax gallinago	4
	—— gallinula	3
Jacanas.	Parra jacana	4
Ostriches.	Dromaius ater	11
	Struthio camelus	9
	Apteryx australis	4
	Tinamus robustus	8
Gulls.	Glareola torquata	4
	Gavia ridibunda	4
	Larus canus	4
Petrels.	Puffinus brevicauda	5
	Diomedea exulans	5
Grebes.	Podiceps rubricollis	9
Totipalmatæ.	Phalacrocorax carbo	9
Divers.	Colymbus septentrionalis	11
	Uria Troile	5
	Alca torda	4
Penguins.	Spheniscus demersus	4

* *Anseranas melanopterus*, a very *Gruine* Goose, has only 6.

This table is large enough for all reasonable purposes; and its results are very striking, and cannot have had their extreme uniformity caused by chance. If we leave out all those birds which, for swimming and especially diving purposes, have the sacrum extremely long and much anchylosed, such as the Sifters, Grebes, Loons, Cormorants, and also the Ostriches (excluding the *Apteryx*), we shall have four post-acetabular joints as the medium number. A large proportion of all birds have exactly four vertebræ in rear of the thigh-bones; many have only three, and about as many more have five. As a rule, the small birds of a group have the tendency to drop a joint occasionally; thus the little *Estrelda* has one less than the other Finches, the Dotterel one less than the other Plovers, and the Crake one less than the other Rails. The medium-sized rapacious birds, both nocturnal and diurnal, have only three. Now, if we consider that all the vertebræ above four in the posterior part of the Duck's pelvis really belong to the tail, then, as I long ago found, the ploughshare-bone is composed of ten segments, as four of the apparently sacral bones are really caudal; and as there are eight intermediate vertebræ, the large number of twenty-two is obtained—one more than the *Archæopteryx* possesses according to Professor Owen's method of enumeration.

Also in the *Palamedea* two of the anchylosed bones belong to the tail; there are six free bones, the last having had a rather late addition in the penultimate joint, so that it may be considered as eleven: this gives us nineteen caudal vertebræ for the subject of this paper—only two less than in the *Archæopteryx*. The same method gives us twenty-four for the Swan, sixteen for the Emeu, and twenty-two for the Cormorant.

That five of the so-called sacral vertebræ of the *Palamedea* belong to the dorso-lumbar region is evident, because the first three have hæmapophyses reaching the sternum, and on the right side there are two more sternal ribs in a rudimentary condition. There are seventeen vertebræ fused together, five of which must be supposed removed from the front part and two from behind, thus leaving ten proper sacral vertebræ.

In small birds and in birds of the higher types with short pelves, the number of true sacral vertebræ will be only about seven on an average—a common number among the large herbivorous Mammalia.

As I have only touched upon the points of interest in this skeleton, when I have acquired a fuller knowledge of it and of its congeners, and of the bearings and relations of the feathered tribes generally, I hope to take it up again. Certainly amongst living birds there is not one possessing characters of higher interest; none that I am acquainted with come nearer, in certain important points, to the Lizard; and there are parts of its organization which make it very probable that it is one of the nearest living relatives of the marvellous *Archæopteryx**.

* The cup-and-ball joints in the dorsal region of many water-birds and of the Parrots must be looked upon as a *general* reptilian character; so also the single head of the "os quadratum" in the Ostriches. The very simple palatines of the latter birds and of the *Palamedea*, the very long free toes and the simple ribs of the Screamer, all these are more properly *lacertian*.

MISCELLANEOUS.

On the Anatomy and Histology of Branchiostoma lubricum, *Costa* (Amphioxus lanceolatus, *Yarrell*). By M. J. Marcusen, of St. Petersburg.

It might be thought that, after the investigations of Johannes Müller and Quatrefages, there would be little to discover in the anatomy and histology of this curious animal. But as it is now nearly twenty years since these naturalists published their memoirs, and as since that time the means of research have been greatly improved, during my residence at Naples I submitted the *Branchiostoma* to a new examination, which has led me to the discovery of many facts unknown to my predecessors, and enabled me to rectify several of their results.

VERTEBRAL SYSTEM.

1. *Dorsal Chord.*—This is composed, as is well known, of a sheath and contents. The latter were described by Goodsir and Müller as consisting of a fibrous mass separable into disks. Quatrefages has denied the existence of the latter, and declared that the dorsal chord is composed of juxtaposed cells, of which he has given figures. According to my investigations, the cells do not exist; and Max Schultze has also been unable to discover them. The dorsal chord separates so readily into disks that they may be recognized even in the living animal, but the separation is not complete. The disks are very thin, their thickness being only $\frac{1}{250}$th mill., and they are united on the two sides by a very delicate substance, which issues from the two surfaces at a great many points, so that in separating one disk from its neighbour the uniting membrane is torn, and its débris present a net-like appearance upon the surface of the disk, giving the latter an aspect of being composed of cells. In reality, however, there is only a smooth disk, of which the surface is covered with shreds of the uniting substance. Sometimes we may see in the substance of the disk itself several perfectly transparent nuclei. Perhaps the network of the uniting substance may represent the remains of cells; but otherwise there are no cells in the dorsal chord of the *Branchiostoma.*

2. *Buccal Cartilage.*—This cartilage, as well as its processes which form the skeleton of the buccal cirri, is also composed of a mass which separates readily into disks; but here the cells of which these are composed have not entirely disappeared, for nuclei of larger or smaller size are seen granulated into an intercellular mass. Quatrefages saw this; but he believed he saw cells without nuclei, with their outlines contiguous—which do not occur.

NERVOUS SYSTEM.

Quatrefages has the credit of having described the distribution of the nerves better than his predecessors; and it is also to him that we owe the interesting observation that the central nervous system is composed of a series of inflations corresponding with the origin of

the nerves; this I have been able to confirm. He has, however, left us in doubt as to the origin of the nerves; and with regard to their terminations his observations are very imperfect, which I attribute to the inferiority of the microscopes of 1844 as compared with those of 1862.

The central nervous system consists of cells and fibres. The cells are very delicate, transparent, round, and filled with granulations, and their diameter is from 0·02 to 0·05 mill.; their little nucleus is only 0·006 mill. in diameter. In the living animal I could not ascertain their presence; and I could only see them after placing the whole animal in a weak solution of chromic acid. The sheath of the central nervous system, discovered by Quatrefages, exists; but the nervous fibres, denied by him, also exist; they are very delicate, straight, and covered with small granulations.

Besides these two elements, there is a great quantity of capillaries in the central nervous system. Quatrefages discovered "that beyond the last inflation the *medulla spinalis* is produced into a delicate filament, which becomes dilated and forms a sort of very distinct ampulla on the level of the extremity of the dorsal chord." The observation is correct; but the ampulla and the whole of this terminal filament are nothing but capillaries, a loop of which forms the ampulla.

The spinal nerves spring from the upper part of the sides of the *medulla spinalis,* as I saw in transverse sections. From this the roots start in the form of a comparatively thick trunk. There are not two roots; but in the interior of the root we find very delicate primitive fibres (cylindraxes), which reach it from different sides. The roots are surrounded by a sheath, in which capillaries may be detected. After its issue the nervous trunk becomes swelled; and I once succeeded in seeing in this swelling a ganglionic cell with its nucleus. It is only behind the swelling that the trunk divides, as described by Müller and Quatrefages. I believe that the swelling represents the spinal ganglion of the vertebrata.

Termination of the Nerves.—Of this, Quatrefages saw two modes: in one he saw and depicted a nervous filament, "terminating in some small ovoid vesicular organs, with proportionally thick walls, which are probably muciparous crypts;" in the other he saw the nerves terminate in transparent homogeneous filaments, which at their very extremity "spread out to form an irregular cone, or a small mamilla applied against the inner layer of the integuments." The structures described by Quatrefages exist, but he observed only the beginning of the end. The little vesicular organs do not constitute a termination, but they are placed in the course of the last ramifications of the nerves. There are two kinds of these bodies—large and small. It is especially in the upper part of the head that I have seen them; in the lower part and in the margin of the fin they are much fewer. But these bodies, which at the first glance have the form of a nucleated cell, are only loops of the nervous fibre; that is to say, the fibre, instead of running straight onwards, turns round upon itself. Sometimes the arrangement is repeated, so that the

same fibre presents several points at which there are these bodies. Where they are large (having a diameter of from 0·012 to 0·020 mill.), the nerve upon which they occur is large. Besides the large bodies, there are smaller ones, only 0·006 mill. in diameter. Large and small loops are found upon the same nerve; but the small loops occur sometimes before and sometimes beyond the large ones. The terminations of the nerves are not in these loops.

In the *Branchiostoma* we have the great advantage of being able to examine the nerves from their origin to their extremities. The space traversed by them in the head is very small. Thus, if we take one of the three nerves which issue from the anterior extremity of the central nervous system, and which, running from above downwards, distributes itself in the lower part of the head, its length from its origin to its termination in the lower margin of the head is only $\frac{4}{5}$ mill. At the origin the trunk is not more than $\frac{1}{30}$—$\frac{1}{40}$ mill. in thickness. At $\frac{3}{15}$ mill. from the origin this nerve divides into three branches, each of which is $\frac{1}{50}$ mill. in diameter. At $\frac{2}{15}$ mill. further on, each branch again divides, and each division is about $\frac{1}{80}$ mill. in thickness. At $\frac{1}{15}$ mill. further, there is another division into several filaments, each $\frac{1}{125}$ mill. in diameter. From this the residue of the divisions has still to traverse a distance of $\frac{6}{15}$ mill. to the lower margin of the head. The thickness of the nerves diminishes to $\frac{1}{250}$ mill.; and from these very delicate filaments the terminations arise, although some have already originated from the anterior trunks. The final terminations are very short branches—little cylinders, which issue from the two sides of the terminal trunks in great quantities, and which measure $\frac{1}{500}$ mill. in diameter and a little more in length. Up to this point, and including the terminal cylinders, the nerves have a transparent sheath with granular contents, which prevent our seeing the primitive nervous fibres which were readily detected in the roots of the nerves. In some places indeed something like fibres may be seen, but this is rare. But at the extremities of the cylinders we see issuing from their midst the terminal nerve-fibres, which are transparent, greyish, without the least trace of granules, and without a sheath. It is only with a power of 450 to 500 diameters that they can be clearly seen. But in order to trace their ultimate distribution a power of 750 diameters is necessary. The terminal fibre, a cylindraxis, measuring 0·0005, 0·0008, and 0·001 mill. in diameter, divides afresh, and becomes a little dilated on issuing; from these inflations, which contain neither nucleus nor granules, issue fibres which run to other small inflations, and so on. In this manner is formed a network, which I at first believed to be terminal; but sometimes, on slightly moving the screw of the microscope, I have seen starting, from what I thought to be the end, other filaments which I could trace no further.

I have said that the cylindraxes divide after issuing from the terminal cylinders; but the primitive fibres of the trunks must also divide. At the origin there are only from five to seven primitive fibres. In forming the terminal cylinders, of which the number amounts to twenty, thirty, or even more, the primitive fibres must subdivide.

Retzius, Müller, Kölliker, and Quatrefages speak of two eyes; Schultze only found a single one. By examining numerous individuals we find that some have two eyes, whilst others have only one. —*Comptes Rendus*, March 7, 1864, p. 479.

Recent Discovery of Fossil Human Remains near Abbeville.

The 'Abbevillois' of the 19th July contains a long account of recent discoveries of human remains in the valley of the Somme, not by the questionable intervention of the labourers, but by the personal exertions of M. Boucher de Perthes and his friends. At Moulin-Quignon, where the celebrated jaw was found, M. Boucher de Perthes has obtained numerous bones of men and animals from depths of from 2 to 4 metres in undisturbed beds; and on the 24th of April in the present year, Dr. Dubois and he found numerous fragments of bone in the yellowish-brown bed, 2 metres from the surface; and 60 centimetres lower down Dr. Dubois caught sight of an imbedded bone which proved to be a human sacrum. In the *sable aigre* in another part of the quarry, a bed so hard as to render the pickaxe necessary, a human tooth was seen fixed in its sandy matrix, and was extracted by M. Boucher de Perthes.

On the 1st of May the same gentleman found, at a depth of $2\frac{1}{4}$ metres in the ferruginous bed, three fragments of a cranium in very bad condition, but probably human. The grey bed furnished, with some other bones, a fragment of a human tooth. On the 12th of May, M. Hersent-Duval, in company with MM. Boucher de Perthes and Dubois, extracted a fragment of a human cranium from its place at a depth of 2·30 metres.

On the 17th of May the party was joined by M. Martin and the Abbé Dergny, when they found and extracted a human cranium, which is said to be remarkably depressed at the summit. None of the party doubted that this bone had occupied the position in which it was found ever since the formation of the bed.

On the 9th of July the examining party was increased in number by several members of the *Société d'Emulation* of Abbeville, and again several fragments of human bones were seen in place and extracted. On the 16th a still larger body, including M. Buteux and M. de Mercey (the latter having come on purpose from Paris), proceeded to the scene of operations; the digging was continued down even to the surface of the chalk, and several human bones were found, one of them at the very bottom of the deposit, upon the chalk itself.

Among the human bones found are two fragments of the upper jaw and an almost entire lower jaw; the latter was obtained at a depth of 4·30 metres, and 22 metres from the resting-place of the jaw found on the 28th of March 1863, which the newly discovered bone is said to resemble in its form.

Discovery of Fossil Stone Implements in India.

At a recent meeting of the Royal Asiatic Society of Bengal, Professor Oldham exhibited a small collection of stone implements which had very recently been discovered by Messrs. King and

Foote, of the Geological Survey of India, near Madras. These were all of the ruder forms, so well known as characterizing the flint implements which have excited so much attention within the last few years in Europe. They were all formed of dense semivitreous quartzite—a rock which occurred in immense abundance in districts close to where these implements had been found, and which formed a very good substitute for the flints of north Europe. This was the first instance in which, so far as he knew, such stone implements had been found in India *in situ*. True celts, of a totally different type and much higher finish, and in every respect identical with those found in Scotland and Ireland, had been met with in large numbers in Central India, but never actually imbedded in any deposits. They were invariably found under holy trees or in sacred places, and were objects of reverence and worship to the people, who could give no information as to the source from which they had been originally gathered together. A single and very doubtful fragment of a stone implement had been found by Mr. W. Theobald, jun., in examining the deposits of the Gangetic plains near the Soane river. This occurred in the Kunkurry clay of that district; but, with this exception, he was not aware of any stone implements of any kind having previously been noticed *in situ* anywhere in India. Those now on the table had been collected partly by himself, from a ferruginous lateritic gravel-bed, which extended irregularly over a very large area west of Madras. In places this was at least 15 feet below the surface, cut through by streams, and in one such place, from which some of the specimens on the table were procured, there stood an old ruined pagoda on the surface, evidencing that, at least at the time of its construction, that surface was a permanent one. This bed of gravel was in many places exposed on the surface, and had been partially denuded; and it was in such localities, where these implements had been washed out of the bed, and lay strewed on the surface, that they were found most plentifully.

Mr. Oldham remarked on the great interest attaching to such a discovery, and on the probable age of the deposit in which they occurred. Another point of interest connected with the history of such implements was the remarkable fact that while, scattered in abundance over the districts where they occurred, were noble remains of what would by many be called Druidical character-circles of large standing stones, cromlechs, kistvaens, often of large size and well preserved, all of which were traditionally referred to the Karumbers, a race of which there still existed traces in the hills, still all the weapons and implements of every kind found in these stone structures were invariably of iron. No information whatever regarding these stone implements could be obtained from the peasantry, who had been quite unaware of their existence.—*Journ. of the Asiatic Society of Bengal*, No. I. (1864).

On the Present State of Malacological Nomenclature. By Philip P. Carpenter, B.A., Ph.D.

At a time when the British Association are about to revise their

"Rules," it may be worth while to collect the experience of workers in different branches of science.

The nomenclature of Mollusca is not only in a most unsettled condition, but there seems no hope of bringing leading writers to an agreement on any first principles. Dr. Gray, whose contributions to malacology are second to none, and whose position at the head of the department in the British Museum would alone give the greatest weight to his example, has systematically ignored the principles on which the British Association Rules are based. The Messrs. Adams in England, Mörch in Copenhagen, many of the German and most of the rising American naturalists take the same course. In France the influence of Lamarck has restrained the modern antiquarian innovation.

Existing writers may be divided into two classes—(1) those who profess the absolute law of priority, and (2) those who accept it with limitations.

The advocates of "mere priority" claim that their rule is the only one which admits of fixed application. It is granted that, if limitations are once allowed, there will be differences of opinion as to their amount: but does the refusal of limitations produce uniformity? Putting aside the variations of opinion as to the greater or less division of genera, how can authors be brought to agree as to wherein the naming of a form consists? Those who compare Dr. Gray's 'Guide' with Adams' 'Genera,' or Dr. Gray's generic names at one date with his names at another, will find that the mere-priority rule is thoroughly uncertain in its application, principally in consequence of the very loose definitions, and probably loose ideas, of the early writers. A modern author *thinks* that Klein or Link meant by a certain name a genus existing in his own mind, which he accordingly calls TALIS, *Klein*. But a second author thinks (and is quite sure he is right in thinking) that TALIS, *Klein*, means what is now considered a different genus, and alters the first author's series of names accordingly. Perhaps Klein meant neither the first, nor the second, nor both; but had a vague idea which it is now only confusing to endeavour to reproduce. The mere-priority writers often judge of the old authors by their types or figures; but even the Linnean genera cannot thus be understood, and many authors place their typical species in the middle of the series.

Once more, among the mere-priority writers, some accept a name only if published with description or figure; others, if the name be *printed* in a list or catalogue; others, if the name be *written* in a public, and others, even in a private collection. But perhaps the namer has only spoken the name, or merely thought it; according to the strictest law of priority, might not even these claim precedence?

If the principle of limitation be once allowed, questions of detail can be debated and settled with tolerable ease; and if one author calls his species *Grayi*, another *grayi*, and a third *Grayana*, we all know what is meant, and that may suffice. But if a modern author quotes a *Cyclas*, a *Capsa*, or a *Siliquaria*, who knows what is meant?

Nomenclature clearly is for USE, not for honour or fancy. That is the best which (1) expresses what it means, and (2) cannot mean

anything else. That moreover is *publication*, in the highest sense, which is found to be in universal use. If in property there is a statute of limitations, and a given number of years' undisturbed possession is tantamount to a right, is there not the same reason for limiting property in a name? Why should not long-accepted Lamarckian names be regarded as much sacred as are considered those of Linnæus?

If such are the difficulties of settling the language of the past, not much less are those of the present. In old times a *Buccinum*, a *Bulla*, a *Mya*, meant almost anything. In Lamarckian times, a *Chiton*, a *Cerithium*, a *Pleurotoma* meant what would now be called a family. If a writer describes under these genera, we know at least in what large division to search for his species. But if he describes a *Rissoa*, a *Modelia*, a *Truncatella*, we have a right to suppose he means what he says, and cannot be expected to look for his species in another suborder. If his *Rissoa* proves to be a *Chrysallida*, his *Modelia* a *Lacuna*, and his *Truncatella* a *Hydrobia*, is he entitled to priority if his successor, anxiously desirous to make out his species, has been compelled though necessary ignorance to redescribe? Very often neither the diagnosis nor the figure represent the real shell. If an author, seeing one object before his eyes, which he calls his type, describes another, and sends a third to the Cumingian collection to represent his species, for which must his name stand? Does it not really belong to the *idea in his own mind* which is embodied in his diagnosis, or (if an artist) in his figure, rather than to the shell which is not represented by either one or the other? A truthful name therefore, even though second or third in time, may be more *useful* to science than a false one given first.

Space only allows us to point out one more difficulty in modern nomenclature. In old times a species (and even a genus) was supposed to be clearly defined. The Darwinian theory offers a satisfactory explanation of some facts in nature, to many who are not prepared fully to accept it. Every worker among large series finds forms which may *or may not* prove conspecific with others, the evidence not being as yet conclusive; he describes these as doubtful ?varieties. Does not the careful naming and description of a *form* establish a claim for priority, whether by succeeding writers that form be regarded as a variety, a species, or even a genus?

It depends much on habit of mind whether authors prefer to work by large or by minute divisions. When we speak of *Callista undulata*, it is a matter of little consequence whether *Callista* be regarded as a subgenus of *Cytherea* or a separate genus, whether *undulata* be regarded as a variety of *planulata* or a distinct species. What is of consequence is, that all the scientific world should have the means of knowing at once what group of forms are included in *Callista*, what kind of individuals in *undulata*. First, then, we need accurate descriptions, then these descriptions condensed into useful nomenclature. Science being a republic, there is no chance of even the forthcoming Rules of the British Association being considered obligatory. But many persons who will not allow themselves to be ruled, against what they consider a principle, may yet be brought to

make concessions. The Academicians had great success in fixing the French language. Why should there not be a congress of malacological authors*, undertaken in a spirit of mutual respect, who should fix such names to existing genera as in each case should prove most *useful* because most widely or easily understood? If travelling is dear, postage is cheap. At present, to teach the science is almost hopeless: to labour in it is fraught to each worker with the unnecessary sacrifice of most valuable time. All considerations of supposed honour to individuals, whether dead or living (which often is equivalent to dishonour, because evidence of work done badly), ought to give way to the manifest benefit, we might almost say necessity, of using words to express a given meaning in science, as we do in common life.

On Hermaphrodite Bees. By Professor von SIEBOLD.

An intelligent apiarian at Constance, M. Engster, was struck, four years ago, by the abundant production of hermaphrodite bees in a Dzierzon hive inhabited by Italian bees. Similar monstrosities have already been occasionally mentioned. At the commencement of this century a schoolmaster of the name of Lukas, described them under the name of "Sting-drones" (*Stacheldrohnen*); but his discovery was regarded as fabulous, and it is only of late that MM. Dœnhoff and Menzel have recognized some hermaphrodite bees. It is fortunate that so competent an observer as Professor Siebold has been able to investigate the abundant supply of these monstrosities furnished by M. Engster's hive, as Dœnhoff ascribes perfect male generative organs to the individuals dissected by him, whilst Menzel always found those organs atrophied.

Professor Siebold differs from both his predecessors, having found among the hermaphrodite bees a mixture of sexual characters not only in those organs which are not directly connected with reproduction, but also in the generative apparatus itself. The mixture of these characters varies greatly in different individuals. It is manifested sometimes only in the anterior, sometimes only in the posterior part of the body; sometimes in all parts of the body, and sometimes only in a few organs. Some individuals present the characters of a drone on the right side, and on the left those of a worker; others are drones in front, and workers behind. The intercalation of different sexual parts sometimes takes place very curiously. Lastly, in some individuals the hermaphroditism is limited to the borrowing of the characters of a single organ (jaws, eyes, antennæ, or feet) from the other sex.

The internal organization presents anomalies of the same kind, but the hermaphroditism of the generative organs is rarely related to that of the external parts. The sting, with its vesicle and poison-gland, is well developed in the hermaphrodites with the abdomen of the worker; it is soft and deformed in those in which the abdomen resembles that of the drone. The oviduct is often furnished with

* This was proposed, for naturalists in general, by Dr. Stimpson: *vide* 'Silliman's Journal' for March 1860, pp. 289–293.

a seminal receptacle, which is always empty. The ovaries are composed of a few tubes, always destitute of ova. In those hermaphrodites of which the abdomen presents exactly the form peculiar to the drones, the copulatory apparatus exists in as complicated a form as usual; the *vas deferens* and the testes are also well formed, and the latter are full of spermatozoids.

A frequent form of hermaphroditism consists in the simultaneous presence on each side of a few testicular coils and ovarian tubes, whilst the epididymis and male copulatory apparatus are well developed, and an imperfect poison-apparatus is also present. In this case spermatozöids are formed, but no ova.

It is interesting to note that these hermaphrodites are seized by the workers at the moment of their issuing from the cells, and thrown pitilessly out of the hive. Their integuments being still soft, they cannot fly, and consequently soon perish. The queen of the hive which furnished these hermaphrodites is of the pure Italian breed, and five years old; she presents no abnormal appearance externally.

Professor Siebold, although unable positively to explain the mode of production of these hermaphrodites, does not consider that they present a phenomenon incompatible with the parthenogenetic theory of Dzierzon. In other animals the semen gives the impulse to the development of the egg; the result of the influence of the semen of the drone is to impress the female character upon the ova, which, if not fecundated, would produce male individuals. The author thinks that we may assume a certain minimum quantity of semen to be necessary for the fecundation of an egg. In most animals a quantity of semen inferior to this minimum, of course, exerts no action, and the egg is not developed; but in bees, whose ova are capable of development without fecundation, things must go on differently. Normally fecundation transforms the male egg of the bee into a female egg. This conversion probably requires the action of a certain number of spermatozoids; but if some accidental circumstance prevents the necessary quantity of spermatozoids from penetrating the vitellus, the egg, without being completely converted into a female one, will nevertheless be disturbed in its development in such a way as to produce a mixture of the characters of the two sexes.—*Siebold and Kölliker's 'Zeitschrift,'* 1864, p. 73.

On the Aërial Roots of the Orchideæ.
By H. Leitgeb.

The cellular tissue forming the outer layer of the aërial roots of tropical Orchideæ, and described by Schleiden under the name of the "root-envelope," is neither placed *above* the epidermis, as supposed by Schleiden and Chatin, nor, as asserted by Schacht and Oudemans, the outer part of the primary bark, and therefore covered by the epidermis, but a cellular structure in the epidermis. The root-envelope is not developed from a cellular tissue already deposited beneath the epidermis by the primitive parenchyma of the vegetative cone, but subsequently and directly from the epidermis by the divi-

sion of its cells, by which means the epidermis itself ceases to exist as such.

Consequently the outermost layer of cells on the surface (of a root-envelope consisting of several layers of cells) is not the epidermis, but is to be regarded, from its mode of production, as equivalent to all the other layers. The cells of this layer may grow out into radical hairs in all plants, but these are frequently produced only when the roots adhere to foreign bodies. The hairs are often ramified and variously thickened, and may be unrolled, in many plants, in spiral bands.

In every root-envelope many cells are perforated when old. This may be proved anatomically in many cases, and may always be demonstrated by injection with insoluble colouring-matters.

The layer of cells situated beneath the root-envelope, and called the "endodermis" by Oudemans, cannot, in accordance with its developmental history, be regarded as epidermis. Fissure-like orifices are never seen in it; and when such have been supposed to be seen, this depends upon an illusion produced by the section. The endodermis is present in the aërial roots of all Orchideæ, and never lies on the surface. It always consists of two kinds of cells—namely, elongated cells the outer walls of which at least are thickened, and shorter cells which are always thin-walled. The latter always have a remarkably large nucleus; the walls of the cells of the root-envelope adjacent to them are usually thickened in a different manner from those which cover the elongated cells of the endodermis. When the root-envelopes consist of but few series of cells, there is over these a group of variously formed cells which may be described as covering-cells (*Deckzellen*).

The cortical parenchyma, the thickened ring, and the medulla present peculiarities in the mode of thickening of their cells which we do not meet with in the aërial roots of plants of other families.

The aërial roots of many Aroïdeæ likewise possess a root-envelope agreeing precisely, both in structure and development, with that occurring in the Orchideæ. The aërial roots of the Cacteæ, on the contrary, are destitute of a root-envelope.—*Bericht der Akad. der Wiss. zu Wien*, May 12, 1864, p. 87.

Description of a new Mustela *from Quito.* By Dr. J. E. Gray, F.R.S. &c.

Mr. Gould has transferred to the British Museum the skin of a small *Mustela*, received from Quito, which is very distinct from any we have previously seen. It is about the size of the European Weasel.

Mustela aureoventris.

Dark brown; chin and side of the throat white; throat, chest, inside of fore legs, and belly golden yellow; whiskers black; tail rather tapering, as long as the body; the soles of the hind feet hairy; the pad of the toes bald, callous, hairy on the sides; ears rounded, hairy. Length of body and head 6 inches, of tail $4\frac{1}{4}$ inches.

Hab. Ecuador.—*Proc. Zool. Soc.* Feb. 9, 1864.

THE ANNALS

AND

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[THIRD SERIES.]

No. 81. SEPTEMBER 1864.

XVI.—*A Description of some Fossil Corals and Echinoderms from the South-Australian Tertiaries.* By P. MARTIN DUNCAN, M.B. (Lond.), F. & Sec. Geol. Soc.

[Plates V. & VI.]

THE interesting simple Corals about to be described came from Muddy Creek and the Murray beds, and the Echinoderms from the latter locality *. The forms are more interesting, as yet, zoologically than geologically; for very little can be determined from them concerning the age of the beds whence they were derived. The great Australian Tertiary formation is not of one age, but the fossils from Muddy Creek and the Murray give part of it a synchronism with the Upper Miocene and older Pliocene of Europe, and with the latest Miocene Coral-beds of the West Indies. Very probably the Tertiaries of Java, described by Mr. Jenkins †, and those whose Echinoderms have been studied by Herklots ‡, are of the same relative age.

List of Species.

1. Caryophyllia viola, n. sp.
2. Flabellum Victoriæ, n. sp.
3. —— Gambierense, n. sp.
4. —— Candeanum, *Edwards & Haime.*
5. Placotrochus elongatus, n. sp.
6. —— deltoideus, n. sp.
7. Balanophyllia Australiensis, n. sp.
8. Trochoseris Woodsi, n. sp.

BRYOZOON.

9. Cellepora Gambierensis, *Busk.*

ECHINODERMATA.

10. Hemipatagus Forbesi, *Woods & Dunc.*
11. Clypeaster folium, var., *Agassiz.*

* Most of the specimens were sent to me by the Rev. J. Woods, of Penola, the learned author of 'Geological Observations in South Australia;' several were already in the cabinet of the Geological Society.

† Quart. Journ. Geol. Soc. vol. xx. p. 45.

‡ Echinoderms (Leyden).

1. *Caryophyllia viola,* nobis, n. sp. Pl. V. fig. 1.

Turbinolia viola, Woods, MS.*

The coral is cuneiform and very compressed at the base, which is rounded inferiorly. The calice is elliptical and shallow. The septa are delicate; the principal are exsert and rounded, having large lateral spiny granules. There are six systems of septa, and four cycles. The three first orders are nearly equal; but the septa of the fourth and fifth orders are small, curve towards and touch the tertiary. The pali are tall rounded lobes on the tertiary septa; they are stout, larger than the end of the septa, and are sparsely granular. The columella is long and papillary. The costæ are visible to the base, are slightly wavy in their course, are separated by distinct grooves, and are of different lengths, those of the higher orders joining the others which reach to the base. All are visibly crenulate and faintly granular.

In form the coral resembles a *Sphenotrochus,* the papillæ on the columella resemble those of *Brachycyathus*: the single row of pali and the distinct costæ determine it to be one of the *Caryophylliæ*; but the absence of an epitheca is remarkable. It is a very beautiful form, and, without its calice, would be taken for an Eocene Turbinolian.

Height $\frac{4}{10}$ inch; length of calice $\frac{3}{10}$ inch, width of calice $\frac{2}{10}$ inch.

Locality.—Violet Creek, near Muddy Creek, South Australia.

2. *Flabellum Victoriæ,* n. sp. Pl. V. fig. 2.

The coral presents a large basilar erosion, the result of the breaking-off of the peduncle: it has a sharp lateral spine on either side, which projects outwards and downwards, and which is situate immediately above the erosion. The coral is tall, compressed more below than above; its sides are slightly concave, and it is furnished with an epitheca which has faint transverse markings. The sides of the coral, were they produced towards the attachment, would form an angle of about 20°; they are rounded off, and only present the spine already noticed. The calice is elliptical; the plane of the smaller axis is slightly higher than that of the larger; the fossa is shallow, but centrally deep, narrow, and long, and the wall is thin. The septa are delicate, not exsert, are very slightly rounded, marked by large granules in series, and are unequal. There are four cycles in six systems, the primary and secondary septa being equal. There is no columella. The costæ are not represented by the

* The specimen was thus labelled by the Rev. J. Woods. I have not seen the MS.

rounded longitudinal markings beneath the epitheca, but the septa are continuous with the furrows between. There are therefore no costæ, but the intercostal spaces are developed into rounded ridges.

Height $\frac{6}{10}$ inch; length of calice $\frac{5}{10}$ inch, breadth of calice $\frac{4}{10}$ inch.

Locality.—Muddy Creek, South Australia.

3. *Flabellum Gambierense*, n. sp. Pl. V. fig. 3.

The coral is tall, faintly curved, has a long tapering pedicel, concave sides, and neither crests nor spines; it is compressed, has a strong epitheca, whose folds are arched and finely linear, and a calice oval-elliptical in shape. The septa are in six systems of four cycles; the primary and secondary are equal, stout, granular, and enlarged internally, where their ends form a rudimentary parietal columella. The other septa are smaller and granular. The costæ are but slightly developed.

Height of coral $\frac{8}{10}$ inch; length of calice $\frac{4}{10}$ inch; width of calice $\frac{3}{10}$ inch.

Locality. Tertiaries of Mount Gambier, South Australia. Coll. Geol. Soc.

4. *Flabellum Candeanum*, Edwards & Haime.

This species, now existing in the Chinese seas, is found fossil in the Murray Tertiaries of South Australia. Coll. Geol. Soc.

5. *Placotrochus elongatus*, n. sp. Pl. V. fig. 4.

The coral is very tall in relation to its breadth, straight, greatly compressed, especially inferiorly, finely pedicellate and cuneiform. The sides are rounded, slightly swollen out here and there, and form an angle of about 15°–20°. The anterior and posterior surfaces are flat. The calice is small, elliptical, and rounded at the sides; it has slightly exsert septa, which are rounded, thin, delicate, unequal, and in six systems of four cycles. The fossa is central, deep, and long; the columella is seen at the bottom of it as a distinct, straight lamella: the columella is stout in the body of the coral, and is thinner at its free edge; laterally it is marked by distinct papillæ, which mark the junction of the principal septa, and it is "essential." The lamellæ of the septa are delicate, highly granular, and are often wavy at the inner margin. The small axis of the calice is slightly higher than the longer. The costæ are faintly marked. The epitheca is in strong curved folds.

Height $\frac{8}{10}$ inch; length of calice $\frac{3}{10}$ inch, breadth of calice $\frac{2}{10}$ inch.

Locality. Muddy Creek, South Australia.

6. *Placotrochus deltoideus*, n. sp. Pl. V. fig. 5.

The coral is conical, finely pedicellate, greatly compressed inferiorly, less so superiorly, has a rugged, sharp, not very prominent costal projection on either side, but is not spined. The calice is large, elliptical, with rather acute ends; apparently, the smaller axis is higher than the longer; its wall is thin, and the fossa is shallow, except centrally, where it is deeper and presents the thin lamellar columella. The septa are numerous, unequal, the larger touching the columella and joining it by small processes, the smaller reaching but a little distance inwards. There are six systems and five incomplete cycles. The septa are not exsert, are feebly arched, and are very delicate; the laminæ are granular, and their internal margin is often wavy. The columella is very sharp, thin, faintly papillate, and distinct. The costæ are small, except the lateral crests. The epitheca is strongly developed, being in arched ridges. The costæ are often chevroned beneath it. The lateral crests form an angle of 60°.

Height of coral 1 inch; length of calice $\frac{9}{10}$ inch, breadth of calice $\frac{4}{10}$ inch.

Locality. Muddy Creek, South Australia.

Variety: *Bursarius*, with the lateral crests forming convex ridges inferiorly.

7. *Balanophyllia Australiensis*, n. sp. Pl. VI. fig. 1.

The corallum is pedicillate, free, long, cylindrical, tapering and occasionally curved. The calice is elliptical, the fossa is shallow, the septa are not exsert, and the columella is large. There are five cycles of septa in six systems, the smaller septa joining others very close to the wall of the calice, which is thin. The costæ are numerous, equal, and consist of fine laminæ, each of which has two rows of delicate dentations connected transversely. The epitheca is seen near the base.

Height of coral $1\frac{1}{2}$ inch; width of calice $\frac{4}{10}$ inch.

Locality. Muddy Creek, South Australia.

8. *Trochoseris Woodsi*, n. sp. Pl. VI. fig. 2.

The coral is fixed by a small pedicel, above which it expands at first irregularly, and then largely. The wall is covered by a pellicular epitheca, which shows traces of subequal costæ. The calice is widely open, irregularly circular, with a thin edge and a small central fossula. The septa are not exsert, are crowded and delicate, there being not much difference in the size of those of the principal cycles; in six systems of five cycles, with half a sixth in each. The smaller septa very generally join the larger, and the larger reach the central fossula. The laminæ

are delicate, straight, and well marked laterally by the synapticulæ. The columella is small.

Height $\frac{7}{10}$ inch; breadth of calice $\frac{6}{10}$ inch.

Locality. Muddy Creek, South Australia.

BRYOZOON.

9. *Cellepora Gambierensis,* Busk.

Locality. Muddy Creek, South Australia.

ECHINODERMATA.

10. *Hemipatagus Forbesi,* Woods & Duncan. Pl. VI. fig. 3.

Spatangus Forbesi, Woods.
Hemipatagus Hoffmanni, Goldf. sp. (Sturt).

This common Echinoderm has been confounded both with the *Hemipatagus Hoffmanni,* Goldf., of Bünde, and with the *Hemipatagus Grignoniensis,* Agass., whose synonym, *Spatangus Omalii,* Galeotti, will be recognized as denoting a form described by E. Forbes in the Belgian Eocene. The Rev. J. Woods has called it *Spatangus Forbesi*; but I cannot find any description of it, although it is figured (p. 75, 'South Australia,' Woods). The species is clearly not *H. Hoffmanni,* and Sturt's mistake was corrected by Mr. Woods. Mr. Woods having figured the species, I append his name with my own.

Test depressed, rather cordiform, nearly as broad as long, rounded and sulcated in front, rather angular laterally and truncated posteriorly. It is highest posteriorly, where it is roof-shaped; and it slopes gradually anteriorly. The ambulacral summit is nearly central. Inferiorly the test is slightly concave and irregular; the plastron is smoother than the rest; the peristome is transverse, semilunar, and there is a prominent posterior lip. The anterior sulcus is broad, shallow, and rounded. The ambulacral areas are lanceolate, the anterior being wide apart. The poriferous zones are sunken and broad; the pores are conjugate; the interporiferous zones are slightly raised, and are faintly tuberculated. There are four generative pores, the anterior pair being closer than the posterior. There are no large tubercles in the posterior interambulacral space or in the posterior third of the central space; they are large and few in the rest of the interambulacral spaces. The very small tubercles of the posterior space are very crowded. The large tubercles which are seen inferiorly also are nearly cylindrical, perforate, but not crenulate; the scrobicula is deep, and the tubercles are often in contact with one part of the scrobicular circle.

Height of specimens $\frac{1}{2}$ inch, length 1 inch.

Locality. The Murray, Mount Gambier, South Australia. Coll. Geol. Soc.

The species is closely allied to *H. Hoffmanni*, Goldf.; but it has non-crenulate tubercles, which have a tendency to touch the scrobicular circle. It is easily distinguished from the Javan Tertiary species, and from the *Hemipatagus Grignoniensis*.

11. *Clypeaster folium*, Agassiz.

Var. with a marginal periproct.

Locality. Muddy Creek, the Murray, South Australia. Coll. Geol. Soc.

Remarks on the Species.

The *Caryophyllia viola* is readily distinguished by the structure of its costæ, the rounded and compressed base, the papillary columella, and the tall pali. At first sight it resembles the *Pleurocyathi* of the German Oligocene, but a careful examination determines its genus readily. The new species has no resemblance to the *Caryophyllia* of the Sicilian Pliocene, and it has not any recent allies. The generic name of *Cyathina* appears to have met with little favour of late; and the species formerly classified under that name are now termed *Caryophylliæ* by M. Milne-Edwards, the old *Caryophylliæ* becoming *Lithophylliæ*.

The three species of the genus *Flabellum* are remarkable: one is known to exist at the present day on the Chinese coast, and the others are new to zoology. *F. Candeanum* and the new *F. Victoriæ* are the first instances of fossil *Flabella truncata*. The species included in this section of the genus have as yet been found as recent Corals in the Chinese, Oceanic, and Australian waters. It was to be expected that some of them, or some extinct members of the section, would be found in the Tertiaries of Australia.

The *F. Gambierense* is a pedicellate species, with a low septal number; and its nearest species (remote, however) is *F. Gallapagense* (Miocene).

The *Placotrochi* are also remarkable; for either both the species indicate that the lamellar columella is an insufficient generic distinction, or they afford an extraordinary example of mimetism in two closely allied genera. The genus *Flabellum* does not differ from the genus *Placotrochus*, except that it has no essential and lamellar columella; but there are parallel species of both genera with the columellar distinction alone. That is to say, there are pedicellate *Flabella* and *Placotrochi*—some compressed, with lateral crests, numerous septa, and wide calices, others without crests, and some are cuneiform: there are truncate species of both genera, and in Jamaica (Miocene of Bowden) there is a section in which both genera are costulated and

without epitheca. The species *P. alveolus* (nobis), from the West-Indian Miocene, is unique.

The first species of the genus were described by MM. Milne-Edwards and Jules Haime*—the *P. lævis* of the Philippines and *P. Candeanus* of the Chinese seas. The next species were described in my Essay on the Fossil Corals of the West-Indian Islands†. The *P. Lonsdalei* resembles the *Flabellum avicula* in many respects; but the *P. alveolus* is unlike any other species in its general shape. Lately some fossils from the Jamaica Miocene have been described by me; but they are not yet published: amongst them are *P. costatus* and the *Flabellum* which is mimetic—the *Flabellum exaratum,* Dunc. MSS. The group then stands as follows, with its mimetic *Flabella*:—

Pedicellate Placotrochi.	*Pedicellate Flabella.*
Placotrochus Lonsdalei, *Dunc.*	Flabellum avicula, *Mich.*, sp.
—— deltoideus, n. sp.	—— Siciliense, *E. & H.*
—— elongatus, n. sp.	—— cuneiforme, *Lonsdale.*
Truncate Placotrochi.	*Truncate Flabella.*
Placotrochus Candeanus, *E. & H.*	Flabellum compressum, *Lamk.*, sp.
—— lævis, *E. & H.*	—— crenulatum, *E. & H.*
Placotrochus without epitheca.	*Flabellum without epitheca.*
Placotrochus costatus, n. sp.	Flabellum exaratum, n. sp.
Anomalous.	
Placotrochus alveolus, *Dunc.*	

The truncate *Flabella* are all recent, except in the instance now noticed; and, until the discovery of *Placotrochus Candeanus* in the Muddy Creek, the truncate *Placotrochi* were the recent forms: all the others belong to the Miocene age. There is no more than a generic relation between the West-Indian and the Australian Tertiary *Placotrochi.*

The new *Balanophyllia* has only a generic affinity with *B. Cumingii,* E. & H., of the Philippines, and is more closely allied to the *B. prælonga,* Michel., sp., of the Turin Miocene: it belongs to the same section of the genus as the Italian form, and they have several peculiarities in common. The new species is nothing like our Crag species.

The *Trochoseris Woodsi* has only a generic affinity with the *T. Stokesi,* E. & H., from the Philippines, and is very distinct from the Eocene forms.

Cellepora Gambierensis, Busk, is a characteristic fossil of the Mount-Gambier Tertiaries.

* Hist. Nat. des Corall. vol. ii. p. 98.

† Quart. Journ. Geol. Soc. vol. xix.

Hemipatagus Forbesi appears to be a common fossil in the South-Australian Tertiaries. The genus is separated from *Spatangus* by Desor*, on account of the defective fascioles and of the absence of large tubercles in the posterior interambulacral area. The European species are found in Eocene and Miocene strata, and *H. Hoffmanni*, the nearest alliance of the new form, is from Malta and Bünde. The species from the Java Tertiaries are not closely allied to the Australian†.

The flat *Clypeaster*, which is also a common fossil, so closely resembles *C. folium* of the Maltese bed (No. 2) as to merit the title of a variety; and this opinion is not weakened by the existence of a *Schizaster* in the Adelaide Tertiaries, which (although defective specimens alone are in my possession) is not distinguishable from *S. Parkinsoni*, Defrance, of Malta.

EXPLANATION OF THE PLATES.

Plate V.

Fig. 1. *Caryophyllia viola*: *a*, front view, natural size; *b*, magnified 4 diameters; *c*, costæ magnified 6 diam.; *d*, septa, pali, and papillary columella, magnified 4 diam.

Fig. 2. *Flabellum Victoriæ*: *a*, front view, natural size; *b*, calice, magnified 2 diam.; *c*, erosion, magnified 2 diam.; *d*, costal arrangement, magnified 4 diam.

Fig. 3. *Flabellum Gambierense*: *a*, front view; *b*, calice, magnified 2 diam.; *c*, epitheca, and *d*, enlarged ends of septa, magnified 4 diam.

Fig. 4. *Placotrochus elongatus*: *a*, front view, natural size; *b*, the same of another specimen; *c*, side view, part of coral removed to show the columella; *d*, calice, and *e*, columella, magnified 4 diam.

Fig. 5. *Placotrochus deltoideus*: *a*, front view; *b*, columella, magnified 4 diam.; *c*, variety *Bursarius*, front view.

Plate VI.

Fig. 1. *Balanophyllia Australiensis*: *a*, front view, natural size; *b*, part of a coral, natural size; *c*, septa, magnified 4 diam.; *d*, costæ, magnified 4 diam.

Fig. 2. *Trochoseris Woodsi*: *a*, corallum, natural size; *b*, septa in calice, magnified 2 diam.; *c*, septa, magnified to show synapticulæ.

Fig. 3. *Hemipatagus Forbesi*: *a*, upper view; *b*, side view; *c*, posterior view; *d*, under side (all natural size); *e*, apicial summit, generative pores, *f*, pores and ambulacral tubercles, *g*, large tubercles, magnified 4 diam.

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* Synopsis des Echinides, p. 416.

† Since the completion of this paper, I have received Karl A. Littel's 'Fossile Mollusken und Echinodermen aus Neu-Seeland.' The *Hemipatagus tuberculatus* therein described, and decided to be specifically distinct from *H. Forbesi*, is very closely allied.

XVII.—*Catalogue of Chrysomelidæ of South Africa.* By the Rev. Hamlet Clark, M.A., F.L.S.

[Continued from p. 124.]

17. *Polysticta Clarkii*, Baly, Trans. Ent. Soc. 1864.

Two examples of a most beautiful species have just been received from Dr. Livingstone's expedition, the exact locality of which was unknown, but in or near the Zambesi country: the species (the largest in the genus) is described in a paper read by my friend Mr. Baly at the last meeting of the Entomological Society, which will shortly be published in the 'Transactions.'

In the cabinets of Mr. Baly and the Rev. H. Clark.

18. *P.* 14-*guttata*, Fab. Ent. Syst. Suppl. 85. 28; Syst. El. i. 432. 55.

One of the most common of the South-African Chrysomelas.

19. *P.* 20-*guttata*, n. sp.

P. ovalis, penitus rotundata, punctato-striata, nigra, maculis 20 circularibus flavis; capite subtilissime punctato, ad medium longitudinaliter foveolato, rufo, labro interdum nigro; thorace elytris angustiore, lateribus penitus parallelis, tenuiter marginatis, disco ad latera crebrius et fortiter, ad medium leviter punctato, nigro (macula rufa interdum undique ad latera, interdum ad medium transverse apparet et magnitudine et facie quam plurimum varians); scutello subtriangulari, lævi, nigro; elytris sat convexis, fere rotundatis, æneo-nigris, maculis undique 10 flavis, circularibus, insulatis, fere æqualibus; corpore subtus nigro, pedibus rufis, antennis rufo-fuscis.

Long. corp. lin. $3\frac{1}{4}$–$3\frac{3}{4}$; lat. lin. $2\frac{1}{2}$–3.

I register this as a separate species with much doubt: it is decidedly more round, less oblong, than *P.* 10-*pustulata*, Thunb., and the punctures on the striæ seem to be a trifle more minute and more separated than in that species. It represents a form that is very common at the Cape.

20. *P. guttata*, Fab. Ent. Syst. i. 313. 28.

P. pardalina (*Coccinella*), Fab. Syst. El. i. 386; Ent. Syst. i. 291. 115.
P. 20-*guttata*, Oliv. (teste Chev.).
P. 10-*pustulata*, Thunb. Mus. Nat. Acad. Upsal. iv. 44. 4; Act. Reg. Soc. Upsal. viii. 182.

A remarkable black variety of this common species has been sent home by my friend Mr. Trimen. The elytra are black, the apex being generally obscurely rufous; the thorax of a bright yellow colour, with the usual markings of fuscous.

21. *P.* 20-*maculata*.

P. ovalis, sat gibbosa, punctato-striata, rufo-ferruginea; capite punc-

tatulo, nigro (interdum fovea media obscura longitudinali); thorace lateribus parallelis (et leviter marginatis), angulis anticis acutis, frontem versus fortiter excavato, ad latera distincte, ad discum lente punctato, æneo-nigro, maculis tribus obscuris (penitus aliquando obliteratis) rufis, media brevi, ea undique obliqua, his scutellum juxta sese attingentibus; scutello lævi, nigro; elytris rotundatis, punctato-striatis, rufo-ferrugineis, maculis undique decem æqualibus, subcircularibus, et æquo intervallo distantibus, seriebus 3 ordinatis, prima (maculas 5 continente) inter suturas 2. et 4., secunda (maculis duabus) inter suturas 5. et 7., tertia (maculis tribus) inter suturas 8. et 10.; corpore subtus pedibusque nigris; antennis rufo-fuscis, ad basin rufo-testaceis.

Long. corp. lin. $3\frac{1}{4}$–$3\frac{1}{2}$; lat. lin. $2\frac{1}{2}$–$2\frac{3}{4}$.

A common species, apparently, at the Cape and in most collections. After a careful examination of a series of examples, I believe that the form here described is specifically distinct from others noticed in this paper: it is more globose in general form than, as well as different in coloration and in markings from *P. guttata*, Fab.; the thorax, as well as the head, is more distinctly punctured, and the legs are rufous and the elytra rufo-ferruginous instead of black. It more nearly approaches in form *P.* 20-*guttata*, and in fact only seems to differ from it by the obscurer and almost obliterated markings on the thorax, the much smaller size of the markings, and the difference of the coloration of the elytra. I have considered, however, that the species are distinct, inasmuch as in the series before me I can trace no appearance of an intermediate pattern.

22. *P. notata*, Fab. Ent. Syst. i. 321; Syst. El. i. 437: Oliv. Entom. v. 534.

A very common species at the Cape and all through the south of Africa, and which would seem to be subject to little variation in pattern. M. Deyrolle has sent it to me from Lake N'gami.

23. *P. modesta*, n. sp.

P. ovalis, sat robusta, punctato-striata, nigro-ænea, maculis rufo-flavis, nitida; capite sparsim et inæqualiter punctato; thorace lateribus haud parallelis, rotundatis (et leviter marginatis), angulis anticis subacutis, ad discum medium lente, ad latera fortiter et crebre punctato; scutello lævi, nigro; elytris distincte punctato-striatis, maculis quibusdam flavis (in seriebus 4 transversis dispositis) ornatis, serie 1^ma^ ad basin a scutello usque ad latus, utraque latiore ad medium tenuiore, 2^da^ ante medium, maculas 2 circulares, sat magnas (hanc inter strias 1. et 4., illam inter strias 6. et 7.) continente, 3^tia^ post medium maculas etiam duas continente (interiorem inter strias 2. et 8., exteriorem inter striam 8. et marginem) hanc ad 2^dam^ apud marginem, illam ad 4^tam^ apud suturam confluentem; 4^ta^ maculis quoque duabus (ambabus margine et sutura ad apicem connexis),

interiore inter strias 3. et 6. subtriangulari, exteriore inter striam 7. et marginem; margo ipse ab humeris ad apicem flavescit; corpore subtus, pedibus antennisque nigris.

Long. corp. $2\frac{3}{4}$ lin., lat. 2 lin.

The above diagnosis will separate this species from all others that have come before me; from several it is clearly separated also by its form (not rotundate, but *sub*parallel) and its size. Its markings may be thus concisely expressed:—(1) humeral, continuous from the suture, round the shoulder, to the margin; (2) antemedial, two distinct, circular, isolated, equidistant, and equal spots; (3) postmedial, two spots, not equal, not isolated, not circular, placed somewhat obliquely, the external being in *front* of the interior; (4) apical, two spots irregular in form, smaller than the preceding, each of them confluent with a flavous apex (but not *reaching* the apex), and the inner one confluent also with the inner postmedial marking; the surface of the thorax also, which is tolerably equally punctate throughout as to the arrangement of the punctures, separates the species clearly from some of its allies.

A single specimen from M. Chevrolat's collection from the Cape.

24. *P. multifida*, Chev. (Dej. Cat.), n. sp.

P. ovalis, sat robusta, punctato-striata, æneo-nigra, nitida; capite subruguloso, interdum etiam fovea obsoleta transversa, nigro; thorace lateribus obliquis et antice rotundatis (leviter marginatis), angulis anticis sat acutis; disco ad medium lente et regulariter, ad latera fortiter et confusim punctato; scutello lævi, nigro; elytris lateribus parallelis, punctato-striatis, maculis flavis inæqualibus undique ornatis, maculæ hoc ordine dispositæ sunt—serie prima (ad basin) macula una, magna, circularis, scutellum penitus attingens inter strias 1. et 5.; secunda ante medium litura una, subquadrata, inter strias 4. et 7.; tertia post medium maculæ duæ, hæc interior, inter strias 2. et 7. transversa, irregularis (juxta suturam latior, marginem versus attenuatior), illa exterior inter strias 8. et 10. marginem attingit; quarta subapicali maculæ duæ dispositæ sunt, inter strias 2. et 6., iterumque inter strias 6. et 10., subconfluentes, forma irregulares, hæc juxta suturam cum vitta flava connectitur; margo etiam ipse omnino flavus est: corpore subtus, pedibus antennisque nigris.

Long. corp. lin. $3\frac{3}{4}$; lat. lin. $2\frac{1}{2}$.

Not far removed in pattern from *A. simulator*, with which it has been confounded in cabinets: it is, at first sight, like it in general markings; but the thorax is narrower and less parallel, the size is larger, the colouring is æneous black (not black), and the markings themselves are larger in size, greater in number, and somewhat differently arranged. I have drawn up the above description from two specimens in my cabinet (from Thom-

son's and Chevrolat's collections), which are absolutely similar in size and form of markings; both of these were registered as from the Cape of Good Hope, under Dejean's name, *A. multifida,* which I am glad to be able to preserve.

25. *P. consimilis,* n. sp.

P. ovalis, sat convexa, punctato-striata, nigra, rufo-flavo notata; capite rufo, thoracis lateribus parallelis, antice rotundatis, marginatis, ad medium rarius et sparsim, ad latera (et basin versus juxta angulos posteriores) fortius punctato, læte rufo, basi et (anguste et suffuse) margine quoque anteriore nigris; scutello subcordiformi, lævi, nigro, nitido; elytris sat rotundatis, punctato-striatis (punctis distantibus et haud ad apicem obsoletis), nigris vel æneo-nigris, maculis quibusdam flavis,—1° duæ ad basin, juxta scutellum et ad humerum (circulares, insulatæ); 2° una ante medium inter strias 4. et 7. (transverso-circularis); 3° una post medium fascia transversa a sutura usque ad marginem (hæc fortasse aliquando in tres vel quatuor maculas divisa); 4° duæ apicem versus, hæc inter strias 3. et 6. circularis, insulata, illa juxta et ad marginem confluens; 5° una apicalis et margine confluens: corpore subtus nigro; pedibus rufis, genibus nigris; antennis rufo-fuscis, ad basin rufis.
Long. corp. lin. 3; lat. lin. $2\frac{1}{5}$.

In pattern this species is almost identical with *P. multifida,* inasmuch as the slight differences that exist might reasonably be attributed to variation; nevertheless the species appears to me to be distinct: the size is much smaller; the colour of the elytra is different—black, instead of æneous black; the thorax and head entirely differ in colour, and in the former the lateral punctures are not nearly so coarse and deep: the punctures of the elytra also differ; they are more closely arranged in this species than in *P. multifida.* The species is also very nearly related to *P. figurata,* Dej., but is separated therefrom by its somewhat different arrangement of punctures on the elytra, and also by its coloration.

A single example in the collection of Mr. Baly.

26. *P. figurata,* Dej., n. sp.

P. ovalis, punctato-striata, cæruleo-nigra, nitida; capite nigro; thorace angustiore et lateribus oblique apicem versus rotundatis, punctatis (apud latera crebrius et fortiter), rufo, ad basin mediam nigro-binotato; scutello lævi, nigro; elytris latis, valde punctato-striatis (punctis crebris et constanter ordinatis), cæruleo-nigris, maculis quibusdam rufis,—1^{ma} apud scutellum inter strias 1. et 4.; 2^{da} inter strias 5. et 7., media, in anteriore parte; 3^{tia} media inter strias 2. et 4. (hæ tres circulares, insulatæ); 4^{ta} fascia transversa, postmedia, subobliqua, attenuata, inæqualis, inter striam 2. et marginem; 5^{ta} et 6^{ta} maculæ duæ juxta apicem inter strias 2–3. et 5–6. oblongæ vel ovales, illa ad apicem affluens; margo quoque

flavus: corpore subtus nigro; pedibus piceis, tarsis rufis; antennis rufis.

Long. corp. lin. 3; lat. lin. 2.

Nearly related in pattern to *P. modesta.* Unfortunately I have some doubt whether the *thorax* of the example before me is not borrowed from some other insect! It is rather smaller in proportion than those of other species.

A single example, from the collection of Mr. Thomson, is in my cabinet, from South Africa.

27. *P. clathrata,* Dej. Cat., n. sp.

P. ovalis, punctato-striata, nigra, rufo maculata, nitida; capite nigro; thorace rotundato (lateribus haud parallelis, tenuiter marginatis), punctato (ad latera crebrius et fortiter), nigro; scutello lævi, nigro; elytris sat rotundatis, punctato-striatis (punctis distinctis, apicem versus obsoletis), nigris, maculis quibusdam rufis,—una scutellaris, inter strias 1. et 6., transversa (aut aliquando minuta), altera media, transversa, inter strias 2. et 9., inæqualis; duæ aliæ postmediæ, magnæ, et ad apicem et marginem affluentes, vel minutæ et insulares; margo quoque flavus: corpore subtus nigro; pedibus nigris, tarsis pallidis; antennis rufo-fuscis, ad basin rufis.

Long. corp. lin. $2\frac{1}{2}$–3; lat. lin. $1\frac{4}{5}$–2.

A species variable both in size and colour; the pattern, however, is sufficiently constant to enable us to separate and limit the species: the humeral and also the apical markings vary considerably in form and size—never, however, the medial, which is transverse and irregular; the margin also is in all cases flavous.

In the cabinets of Mr. Baly, Mr. Wilson Saunders, and the Rev. H. Clark.

28. *P. Hebe,* n. sp.

P. ovalis, penitus rotundata, punctato-striata, rufa, maculis nigris, nitida; capite sparsim punctulato, nigro; thorace lateribus subparallelis, antice rotundatis, leviter marginatis, elytris haud multum angustiore, in disco leviter, ad latera forte punctato, æneonigro; scutello subcordiformi, lævi, nigro; elytris sat latis, punctato-striatis (punctis distinctis, crebris, ordinatis), rufis, vittis 3 transversis (e maculis distinctis compositis), æneo-nigris,—prima juxta (sed haud attingens) basin, maculas tres continet (1^{mam} inter strias 2. et 3. subcircularem; 2^{dam} inter strias 4. et 5.—hæc in vittam 2^{dam} confluit; 3^{tiam} inter strias 6. et 10. irregularem, obliquam); secunda vitta media maculas tres quoque continet (1^{mam} inter suturam et striam 3., 2^{dam} inter strias 4. et 5.—hæc in vittam basalem confluit,—3^{tiam} inter strias 6. et 7.); tertia vitta postmedia, hæc vel quatuor maculas continet vel transversa vitta est a sutura ad marginem, juxta apicem etiam est macula subcircularis insularis; sutura quoque nigra: corpore subtus, pedibus et, ut credo, antennis nigris.

Long. corp. lin. $2\frac{1}{2}$; lat. lin. $1\frac{3}{4}$.

This beautiful little species was received by me from M. Chevrolat's collection. The locality is unrecorded.

29. *P. flavo-sparsa*, n. sp.

P. elongato-ovalis, punctato-striato, æneo-nigra, maculis flavis notata, nitida; capite transverse arcuato, etiamque longitudinaliter foveolato, punctato, æneo-nigro; thorace lateribus angulisque anticis rotundatis, ad discum subtilissime et sparse, ad latera fortiter punctato, æneo-nigro; scutello lævi, nigro; elytris subconvexis, punctato-striatis (punctis distinctis æqualiter ordinatis et distantibus), æneo-nigris, maculis 8 undique instructis,—1^{ma} ad scutellum inter strias 1–4., circularis; 2^{da} ad humerum inter striam 7. et marginem, oblique ovalis; 3^{tia} antemedia, inter strias 4–7., circularis; 4^{ta}, 5^{ta} et 6^{ta} mediæ vel paulum postmediæ, inter strias 2–5. (transversa, irregularis), 5–7. (subcircularis); 8^{va} ad marginem (subquadrata), 7^{ma} et 8^{va} apicales, inter strias 3–6. et 7–10. (illa ad apicem affluens); margo quoque flavus: corpore subtus pedibusque nigris; antennis rufo-fuscis, ad basin rufis.

Long. corp. lin. 3; lat. lin. $1\frac{3}{4}$.

The above diagnosis is taken from a single specimen. It is possible that the three medial markings may in some cases be merged into one irregular transverse band. In *pattern* the species reminds us somewhat of an aberrant *P. multifida*; it is much smaller, however, and the punctures on the elytra are coarser and deeper.

From M. Chevrolat's collection, from the Cape.

30. *P. vulpina*, Fab. Ent. Syst. i. 321; Syst. El. i. 437: Oliv. Entom. v. 534.

The smallest species of the genus, and variable in pattern. It would seem to be not uncommon at the Cape. I have received it from M. Deyrolle, from Karoo, Kaffraria.

It will be seen that I have omitted for the present notices or descriptions of five of the species recorded at page 116 of this volume: these I hope to refer to on some future occasion.—H. C.

XVIII.—*Notice of Spiders, indigenous to the Salvages, received from the* Barão do Castello de Paiva. By John Blackwall, F.L.S.

The following spiders collected on the Great Salvage, the chief of a group of small rocky islands, difficult of access, situated between Madeira and the Canary Islands, were transmitted to me by T. Vernon Wollaston, Esq., at the request of the Baron de Paiva; and, independently of the probability that they are

all new to science, they possess an especial interest arising from the very peculiar character of the locality in which they were found. How these species were originally introduced into this small, isolated, and desolate spot is a difficult problem to solve; but, as it is well known that, under favourable circumstances, spiders are borne through the atmosphere to prodigious distances by currents of air acting upon their silken lines, it is possible that they may have been thus conveyed, in an immature state, from the continent of Africa, or from some of the less distant islands, to their present singular habitat. Should this supposition be well founded, the wide distribution of spiders of the same species will cease to be regarded as a marvellous phenomenon.

Tribe **Octonoculina.**

Family DRASSIDÆ.

Genus DRASSUS, Walck.

Drassus Paivani, n. sp.

Length of the female $\frac{3}{8}$ths of an inch; length of the cephalothorax $\frac{3}{16}$; breadth $\frac{1}{7}$; breadth of the abdomen $\frac{1}{7}$; length of a posterior leg $\frac{1}{2}$; length of a leg of the third pair $\frac{3}{8}$.

The eyes are disposed on the anterior part of the cephalothorax in two transverse rows; the two intermediate ones of the posterior row, which is almost straight, are nearer to each other than they are to the lateral eyes of the same row, which are the smallest; the anterior row is the shorter, and is curved, having its convexity directed upwards; the two intermediate eyes are the largest and darkest-coloured of the eight, and the lateral eyes of both rows are separated by a wide interval. The cephalothorax is large, convex, depressed towards each extremity, thinly clothed with hairs, compressed before, rounded and depressed on the sides, which are marked with slight furrows converging towards a narrow indentation in the medial line of the posterior region; it is of a yellowish-brown hue; a longitudinal band on each side of the cephalic region, and the oblique lateral furrows, are soot-coloured, the latter being the paler, and the lateral margins have a brownish-black hue. The falces are powerful, conical, slightly prominent, provided with long hairs, and are of a red-brown colour. The maxillæ are long, rounded at the extremity, near which there is an oblique transverse furrow, and curved towards the lip, which is oblong and notched at the apex; the sternum is oval, the posterior being rather broader than the anterior extremity; it is supplied with hairs, those on the margins being the longest and darkest-coloured; the legs are robust; they are clothed with hairs, and the third and fourth pairs are provided with sessile spines; each tarsus is terminated by two

curved claws, toothed at the base, and has hair-like papillæ on its inferior surface; the fourth pair is the longest, then the first, and the second pair slightly surpasses the third; the palpi are short, supplied with hairs and spines, and have a curved claw at their extremity. These parts have a dull brownish-yellow hue, the lip and sternum, which are the darkest, being tinged with red. The abdomen is oviform, convex above, projecting over the base of the cephalothorax, and is thinly clothed with hairs: it is of a pale dull brownish-yellow colour; at the anterior extremity, close to its junction with the cephalothorax, there is a transverse, curved, dark-coloured mark, thickly covered with long black hairs, whose convexity is directed upwards; a longitudinal soot-coloured band, which is bifid at its extremity, and of a dull brownish-yellow hue in the medial line of its anterior part, extends nearly half the length of the upper part; to this band a series of rather obscure, soot-coloured, angular lines succeeds, which diminish in extent as they approach the spinners; their vertices are directed forwards, and their extremities are considerably enlarged; the sides are marked with oblique bands of the same hue, the anterior one being much the broadest; and there are a few small soot-coloured spots on the under part; the two inferior spinners are rather the longest, and cylindrical, and the two intermediate ones, which are biarticulate, have the basal joints united throughout their entire length, but the terminal joints are free and divergent; the sexual organs are moderately developed, of a dark red-brown colour, and have a short, obtuse, pale process connected with their anterior margin. Some individuals are paler and less distinctly marked than others, the dark-coloured lines being represented by rows of spots.

Drassus Paivani appears to occur in much larger numbers on the Great Salvage than any other spider. There were forty-nine females in the collection, either in an adult or immature state; but it is a curious fact that it did not contain a single male.

I have much pleasure in connecting with this fine *Drassus* the name of that distinguished naturalist, the Baron de Paiva, to whose liberality I am indebted for the interesting particulars comprised in this communication, relative to the spiders found to inhabit the Salvages.

Drassus Bewickii, n. sp.

Length of the female (not including the spinners) $\frac{5}{12}$ths of an inch; length of the cephalothorax $\frac{1}{5}$; breadth $\frac{1}{8}$; breadth of the abdomen $\frac{1}{6}$; length of a posterior leg $\frac{9}{20}$; length of a leg of the third pair $\frac{1}{3}$.

This spider bears so close a resemblance to *Drassus Paivani* in the relative size and disposition of its eyes, in its colours and

the design formed by their distribution, and also in the relative length and proportions of its legs, that the description of one might well serve for that of the other, were it not for the remarkable difference in the structure of their spinners, *Drassus Bewickii* having the superior pair of those organs very long, cylindrical, and triarticulate, with the spinning-tubes distributed on the extremity of the short terminal joint; the extraordinary length of the middle joint of these spinners constitutes an important and conspicuous character, by which it may be readily distinguished, not only from *Drassus Paivani*, but also from every other known species of the genus.

This and the preceding species belong to Walckenaer's family *Lithophilæ*, of the genus *Drassus*. There were eight specimens of this spider in the collection, all of which were either adult or immature females.

I have conferred on this remarkable species the name of Mr. Bewicke, a zealous and careful observer of nature, who, having collected numerous specimens of spiders in the island of Madeira, transmitted them to Mr. Wollaston, by whom they were kindly placed at my disposal. In describing the new species comprised in that collection in the 'Annals and Mag. of Nat. Hist.,' third series, vol. ix. page 370, my omission to acknowledge the obligation I was under to those gentlemen must be attributed to my not having received information of the circumstance at that time.

Family Agelenidæ.

Genus Tegenaria, Walck.

Tegenaria dubia.

Length of an immature female (not including the spinners) $\frac{3}{10}$ths of an inch; length of the cephalothorax $\frac{1}{7}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{1}{2}^{3}$; length of a leg of the third pair $\frac{2}{5}$.

The eyes are seated on black spots, and are disposed on the anterior part of the cephalothorax in two transverse rows; the posterior row, which is rather the longer, is slightly curved, with its convexity directed backwards, and the anterior row is almost straight; the four intermediate eyes describe a trapezoid whose shortest side is before, the two posterior ones being the largest and the two anterior ones the smallest of the eight; the eyes of each lateral pair are placed obliquely on a tubercle, but are not in contact. The cephalothorax is convex, glossy, compressed before, and rounded on the sides, which are depressed, and marked with furrows converging towards a narrow, oblong indentation in the medial line of the posterior region; it has a brownish-yellow hue, with a broad, irregular, faint soot-coloured

band extending along each side, and narrow lateral margins of the same hue. The falces are powerful, conical, vertical, armed with teeth on the inner surface, and somewhat darker-coloured than the cephalothorax, having a tinge of red. The maxillæ are straight, and narrower at the base than at the extremity, which is rounded; the lip is nearly quadrate, being rather broader at the base than at the apex; the sternum is heart-shaped, and pointed at the extremity; the legs and palpi are long, slender, and provided with hairs and spines; the first pair of legs is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base, which has one or two minute teeth on each side; the palpi have a curved pectinated claw at their extremity. These parts are of a brownish-yellow hue, the lip being the brownest on the sides; the sternum has soot-coloured annuli on the lateral margins, opposite to the legs; and the legs have a few annuli of the same hue on the femora. The abdomen is oviform, convex above, projecting over the base of the cephalothorax; it is thinly clothed with short hairs, and of a dull yellowish colour tinged with brown; a series of spots extends along each side of the medial line of the upper part, several of which unite immediately above the spinners; some streaks and small spots occur on the sides, and three longitudinal lines on the under part; these spots and lines are soot-coloured and rather obscure: the spinners have a yellowish-white hue, the two superior ones, which are the longest and triarticulate, with the spinning-tubes distributed on the inferior surface of the taper terminal joint, having the medial joint of a brownish-black colour.

The collection contained three females of this *Tegenaria*; but, as they were immature, I cannot positively assert that the species is undescribed, though I am strongly inclined to believe that such is the case: this doubt is implied in the specific name provisionally given to it.

Family Theridiidæ.

Genus Theridion, Walck.

Theridion —— ?

One specimen of a female *Theridion,* whose abdomen had been so much injured by maceration in spirit, and whose legs had suffered so greatly from mutilation, that it was not possible to ascertain whether it was undescribed or not, was the only representative of the genus in the collection. From certain circumstances in connexion with this spider, I am disposed to believe that, when captured, it had recently changed its integu-

ment, and consequently was in a condition very liable to sustain injury.

Its eyes are seated on black spots, and are disposed on the anterior part of the cephalothorax in two transverse rows; the four intermediate ones, which are placed on a small prominence, nearly form a square, and the two anterior ones are rather the smallest and darkest of the eight; the eyes of each lateral pair are seated obliquely on a tubercle, and are contiguous. The cephalothorax is oval, convex, glossy, with an indentation in the medial line of the posterior region; the falces are conical and vertical; the maxillæ are obliquely truncated at the extremity, on the outer side, and inclined towards the lip, which is triangular; the palpi are moderately long, hairy, and terminated by a curved pectinated claw. These parts have a pale dull yellowish hue; and the legs, judging from some of the coxæ and femora and portions of the tibiæ, are of the same colour.

Tribe Senoculina.

Family Dysderidæ.

Genus Dysdera, Latr.

Dysdera Wollastoni, n. sp.

Length of the female (not including the falces) $\frac{13}{24}$ths of an inch; length of the cephalothorax $\frac{5}{24}$, breadth $\frac{1}{6}$; breadth of the abdomen $\frac{3}{20}$; length of an anterior leg $\frac{7}{10}$; length of a leg of the third pair $\frac{9}{20}$.

The cephalothorax is somewhat compressed before, rounded in front and on the sides, moderately convex, glossy, with a shallow indentation in the medial line of the posterior region; it is thinly clothed with short hairs, and of a dark red-brown colour. The falces are conical, prominent, and armed with a long curved fang and a few small teeth on the inner surface; the maxillæ are straight, greatly enlarged at the base, where the palpi are inserted, and pointed at the extremity; and the lip is long and notched at the apex. These parts are of a dark red-brown colour, the maxillæ being the palest. The sternum is oval, and has a red-brown hue, the margins being rather the darkest. The legs are long, moderately robust, glossy, sparingly clothed with hairs, and the tibiæ, metatarsi, and tarsi of the third and fourth pairs are provided with spines, a few short ones also occurring near the base of the femora of the latter on the upper surface; they have a yellowish-red hue, the metatarsi and tarsi of the third and fourth pairs being the palest; the first pair is the longest, then the fourth, and the third pair is the shortest; each tarsus is terminated by two curved slightly pectinated claws, and below them there is a small scopula; the

palpi are long, and resemble the legs in colour. The eyes are closely grouped in the form of a small oval open in front, on a slight eminence at the anterior part of the cephalothorax, and the two anterior ones are the largest of the six. The abdomen is of an oblong oviform figure, somewhat convex above, and projects very little over the base of the cephalothorax; it is sparingly clothed with hairs, and has on its upper part numerous short, strong, black bristles, more or less erect; its colour is dark yellowish brown, the two extremities and the under part being the yellowest; and the lips of the branchial and tracheal stigmata have a red-brown hue.

The male closely resembles the female, but it is smaller, and its abdomen is slenderer and more cylindrical. The digital joint of its palpi is shorter than the radial joint, and the palpal organs are connected with it by a short pedicle on the under side; they are prominent, somewhat oviform at the base, abruptly bent towards the extremity, which terminates in a point, and have a strong pointed process situated immediately above the abrupt bend; their colour is red-brown, that of the base of the pointed process being yellowish white, and the oviform part is marked with a spiral band of a browner hue, apparently produced by the convolutions of an internal vessel.

Two adult males and five females of this species, two of the latter being immature, were comprised in the collection.

I dedicate this new species of *Dysdera* to T. Vernon Wollaston, Esq., one of our most accomplished coleopterists, whose valuable researches have contributed largely to extend our knowledge of the entomology of Madeira, and to whom I am obliged for opportunities of describing various interesting spiders captured in that island.

XIX.—*Descriptions of Twenty-six new Species of Australian Land-Shells.* By James C. Cox, M.D., Sec. Entomological Society of New South Wales.

1. *Helix Blomfieldi*, mihi.

H. testa subglobosa, apice obtusa; anfractibus septem, rotundatis; concentrice minute striata; apertura ovato-elongata; sutura impressa et alba, ustulato-rufa, apice flavicante et spiraliter lineata; labro crassissimo, reflexo, columella labroque violaceis.

Diam. maj. 1·064, min. 1·040, alt. 1·048 unc.

Hab. Miriam Vale, Port Curtis (Cox). Mus. C.

2. *Helix Belli*, mihi.

H. testa late et perspective umbilicata, discoidea, depressa et sub-

concava, regulariter costellato-striata, rufo-castanea, nitidiuscula; anfractibus quinque convexiusculis, ultimo tumido rotundato; spira submersa; sutura profunde impressa; apertura lunari; peristomate simplici, recto.

Diam. maj. 0·07, min. 0·06, alt. 0·02 unc.

Hab. Green-oakes, Darling Point, Sydney (Bell). Mus. C.

3. *Helix conoidea*, mihi.

H. testa umbilicata, conoidea, sordide lutescente, ad apicem griseo-plumbea, parum nitente, irregulariter sulcata et costata; anfractibus septem, plano-convexiusculis, ultimo carinato; spira obtusa; apertura lunari-ovata, tenui.

Diam. maj. 0·37, min. 0·35, alt. 0·30 unc.

Hab. Cabbage-Tree Island, Port Stephens (King). Mus. Rev. R. L. King.

4. *Helix Lyndhurstensis*, mihi.

H. testa ample aperte umbilicata, pellucida, rotundato-depressa, obsolete striata, glabra, nitida; spira obtuso-convexa, fuscescente; anfractibus quatuor aut quinque, ultimo dilatato; apertura lunato-circulari; peristomate simplici, acuto.

Diam. maj. 0·16, alt. 0·06 unc.

Hab. Lyndhurst, Sydney (King). Mus. Rev. R. L. King.

5. *Helix Mitchellæ*, mihi.

H. testa imperforata, subgloboso-turbinata, oblique concentrice striata, sub lente minute granulata, intense castanea, duabus lineis nigris et duabus luteis fasciata; spira elevata; anfractibus septem, convexiusculis, ultimo angulato; apertura obliqua, transversim ovali; labro reflexo; intus intense lilacea, marginibus callo junctis.

Diam. maj. 1·056, min. 1·050, alt. 1·015 unc.

Hab. Clarence River (Mitchell). Mus. Mrs. James Mitchell.

6. *Helix Mastersi*, mihi.

H. testa anguste umbilicata, depresso-conoidea, radiatim rugoso-striata, undique minute granulata, subpellucida, saturate castanea; spira depressà; anfractibus sex, vix convexiusculis, ultimo angulato; columella lævi et dilatata, umbilicum semitegente; apertura lunato-subcirculari, marginibus conniventibus; labro tenui, vix dilatato, intus livido.

Diam. maj. 1·19, min. 0·98, alt. 0·65 unc.

Hab. Merimbula, New South Wales (Masters). Mus. C.

7. *Helix microscopica*, mihi.

H. testa umbilicata, conoidea, rubido-cornea, pellucida, nitente; anfractibus quinque, gradatim increscentibus; spira obtusa; sutura impressa; costis crebris transversalibus elevatis, interstitiis

minutissime punctato-striatis; apertura rotundato-lunari; peristomate simplici.

Diam. maj. ·0·04, alt. 0·02 unc.

Hab. Stroud (King). Mus. Rev. R. L. King.

8. *Helix Morti*, mihi.

H. testa late et profunde umbilicata, depresso-convexa, costato-rugosa, sub lente interstitiis minutissime et decussatim striato-punctulatis, solidiuscula; anfractibus quinque, convexiusculis, ultimo rotundato; sutura impressa; apertura fere rotundata; peristomate simplici, acuto, margine columellari paulo reflexo.

Diam. maj. 0·08, min. 0·07, alt. 0·04 unc.

Hab. Green-oakes, Darling Point, Sydney (Macgillivray). Mus. C.

9. *Helix Kreffti*, mihi.

H. testa anguste umbilicata, convexo-depressa, nitida, subpellucida, striatula, cornea, subtus opaca; anfractibus sex, convexis; apertura rotundato-lunari, margine columellari dilatato, umbilicum semitegente.

Diam. maj. 0·57, min. 0·49, alt. 0·31 unc.

Hab. Cape York (Macgillivray). Mus. C.

Only one specimen found.

10. *Helix Stroudensis*, mihi.

H. testa subampliter umbilicata, discoidea, fuscescente, tenuiter costellato-striata, convexa; sutura impressa; anfractibus quinque; spira truncata; peristomate simplici, acuto; apertura lunato-ovata.

Diam. maj. 0·12, alt. 0·05 unc.

Hab. Stroud, Port Stephens (King). Mus. Rev. R. L. King.

11. *Helix marmorata*, mihi.

H. testa umbilicata, depresso-convexa, lævigata, obsolete interne striata, nitidissima, rufo-cornea, basi subcompressa; anfractibus sex; spira late conoidea; apertura lunari; peristomate recto simplicique, margine columellari basi parum reflexo, vix umbilicum minutum subobtegente.

Diam. maj. 0·40, min. 0·34, alt. 0·22 unc.

Hab. Kiama (Masters); Fernhill, Penrith; Port Curtis; Broken Bay (Cox). Mus. C.

12. *Helix Strangeoides*, mihi.

H. testa late et profunde umbilicata, depressa, flavo-cornea, superne confertim tenuissime striata, lineis minutissimis decussata, inferne lævigata; lineis obsoletis interne striatis; anfractibus quinque, ultimo declivi, rotunde convexo, cæteris planiusculis; apertura subobliqua, lunari-rotundo; peristomate tenui, simplici.

Diam. maj. 0·38, min. 0·32, alt. 0·16 unc.

Hab. Moreton Bay (King). Mus. Rev. R. L. King.

13. *Helix Parramattensis*, mihi.

H. testa imperforata, depresso-globosa, conica, lævissima, tenui, nitente, flavicante; sutura impressa; anfractibus sex, ultimo convexo, ceteris subæquantibus; spira obtusa; apertura ovato-lunari; peristomate simplici rectoque.

Diam. maj. 0·12, min. 0·10, alt. 0·09 unc.

Hab. Parramatta (King). Mus. C.

14. *Succinea Nortoni*, mihi.

S. testa ovata, tenui, ventricosissima, pellucido-cornea, apice rufescente; anfractibus quatuor, longitudinaliter ruditer et irregulariter elevato-striatis, ultimo perampliter inflato; labro simplici; apertura ovata; columella peristomateque continuatis.

Long. 0·47, diam. 0·36 unc.

Hab. Norton's Basin, Nepean River, N.S.W. (Cox). Mus. C.

15. *Succinea Macgillivrayi*, mihi.

S. testa ovata, ventricosissima, sordide fusca, versus apicem rosacea; anfractibus tribus, sub lente minute striatis; apertura perampla, ovata; labro simplici; columella peristomateque continuatis.

Long. 0·30, diam. 0·20 unc.

Hab. Mount Henry, Mulgoa, N.S.W. Under stones in moist places (Cox). Mus. C.

16. *Succinea rhodostoma*, mihi.

S. testa elongato-ovata, ventricosa, solidiuscula, opaca, nitente, albida, ad apicem roseo tincta; anfractibus quatuor, longitudinaliter ruditer et irregulariter elevato-striatis; labro simplici, intus rosea porphyracea; apertura ovata.

Long. 0·50, diam. 0·27 unc.

Hab. Point Lowly, South Australia (Cox). Mus. C.

17. *Pupa Kingi*, mihi.

P. testa sinistrorsa, profunde et breviter rimata, ovato-oblonga, tenui, lævigata, nitida, hyalina, rubido-castanea; spira convexa, apice obtusa; anfractibus quatuor, convexiusculis, ultimo semilongitudinem testæ vix æquante; apertura verticali, irregulariter constricta et subbipartita, tridentata, dente conspicuo acutiusculo in pariete aperturali, altero minore latiore et obtuso in columella, tertio minimoque in margine externo; peristomate incrassato et breviter expanso; ore rubido, dentibus albis.

Long. 0·05, diam. 0·03 unc.

Hab. Parramatta (King). Mus. Rev. R. L. King.

18. *Pupina Wilcoxi*, mihi.

P. testa ovata, nitidissima, hyalina, rubro-lutescente, tenuiuscula; spira obtusa; anfractibus sex, duobus ultimis æqualibus et maximis, ceteris gradatim decrescentibus; apertura obliqua, orbiculari, externe producta; peristomate albo, vix incrassato, non continuo,

reflexo, canalibus duobus interrupto, canali superiore ad partem superiorem vel angulum aperturæ, inferiore ceterum vix æquante.

Diam. 0·17, long. 0·35 unc.

Hab. Clarence River, N.S.W. (Wilcox). Mus. C.

19. *Pupinella Macgillivrayi*, mihi.

P. testa imperforata, ovato-oblonga, glabra, nitida, pellucidaque; spira ventrosa; anfractibus septem, convexiusculis, minutissime transversim striatis, ultimo maximo, penultimo ceteros æquante; apertura subverticali, circulari; peristomate incrassato alboque, canalibus duobus angustis.

Long. 0·50, diam. 0·24 unc.

Hab. Port Denison, Queensland (Cox). Mus. C.

20. *Pupinella Whartoni*, mihi.

P. testa umbilicata, acuminato-oblonga, solidiuscula, luteo-fulva aut corneo-fusca; anfractibus septem, modice convexis, ultimo penultimo longiore, ceteris decrescentibus, tumidiusculis, sub lente transversim minute striatis; sutura indentata; apertura subverticali, circulari; peristomate albido, margine ubique expanso et subreflexo, non antice dilatato ut in *Pupinella Borneensi.*

Long. 0·59, diam. 0·47 unc.

Hab. Port Denison and Port Curtis, Queensland (Cox). Mus. C.

21. *Helicina Gladstonensis*, mihi.

H. testa globoso-turbinata, carinata, infra vix callosa, fuscescente, maculata; anfractibus quatuor; apertura semicirculari; peristomate reflexo alboque; operculo corneo.

Diam. maj. 0·16, min. 0·12, alt. 0·10 unc.

Hab. Gladstone, Port Curtis, Queensland (Cox). Mus. C.

22. *Helix costulata*, mihi.

H. testa late et perspective umbilicata, solidiuscula, discoidea, superne inferneque regulariter costata, rufo-fuscente, opaca; anfractibus quatuor, convexis, ultimo subrotundato; spira subconcava; sutura impressa; apertura lunari, subverticali; peristomate simplici rectaque.

Diam. maj. 0·10, min. 0·09, alt. 0·06 unc.

Hab. Green-oakes, Darling Point, Sydney, N.S.W. (Macgillivray). Mus. C.

23. *Pupa Ramsayi*, mihi.

P. testa dextrorsa, fusiformi-oblonga, solidiuscula, nitida, albida, ad apicem fusca; spira obtusa; anfractibus quinque, convexiusculis, longitudinaliter obsolete tenuiter striatis, 3°, 4° et 5° gradatim decrescentibus; apertura obliqua, late ovata, antice fere angulata, dentibus parvis obtusis in pariete aperturali; peristomate vix incrassato, breviter expanso; ore dentibusque albis.

Long. 0·20, diam. 0·09 unc.

Hab. Point Lowly, South Australia (Cox). Mus. C.

24. *Bulimus Walli*, mihi.

B. testa acuminato-elongata, gracili, minute umbilicata; anfractibus octo, minute transversim striatis; intense brunnea; apertura parva; columella parum reflexa; labro simplici.

Hab. Kalka, Rockhampton (W. S. Wall, jun.).

Diam. 0·12, alt. 0·44 unc. Mus. C.

The same type of shell as *B. Tuckeri.*

25. *Bulimus Onslowi*, mihi.

B. testa subobtecte perforata, ovata, solidiuscula, striata, albescente vel pallide cornea fasciis crebris transversalibus rufescentibus; spira conica, obtusa; sutura profunda; anfractibus quatuor, parum convexis, striis plurimis semiregularibus spiralibus transversisque sculptis, ultimo ventroso, spiram duplo dimidioque superante; apertura subverticali, angulato-ovali, intus pallide plumbea; peristomate simplici, tenui; margine columellari albido, reflexo, basi adnato.

Long. 0·85, diam. 0·60 unc.

Hab. Dirk Hartog's Island, Shark Bay, Western Australia (Onslow). Australian Museum.

26. *Bulimus Jacksonensis.*

B. testa ovato-conica, imperforata; anfractibus quatuor, vix convexiusculis, glabris, nitidis, ultimo duplo ceteros æquante; spira obtusa; sutura impressa; apertura ovata; labro simplici, corneo pellucidoque; columella recta.

Long. 0·14, diam. 0·05 unc.

Hab. Darling Point, Port Jackson (King &c.).

XX.—*Histological Researches on the Formation, Development, and Structure of the Vegetable Cell.* By Prof. H. Karsten.

[Concluded from p. 133.]

§ XI.

Intercellular substance.—Cuticle.—Metamorphosis of the substance of the different membranes of a joint-cell, and their development independently of the operation of a primordial utricle.—Formation of layers by the cell-membrane.—Difference between a cell-membrane and a layer of cell-membrane.—Varieties and causes of the transformations of the originally structureless cell-membrane. — Untenability of the hypothesis of a primordial sac.

There are two antagonistic hypotheses in histology, viz. that of endogenous cell-formation and that of cell-fission; but there is a general concurrence on this point—that the walls of existing cells may be thickened in layers.

By this laminated thickening (of the true nature of which, however, very different conceptions are adopted) the adherents

of the fission-theory account not only for the nested membranes occurring in every individual cell, but even for the general cellular envelope of the entire organism (cuticle), and also for the intercellular substance, at least as far as the existence of the latter is admitted by them.

According to this theory, the outer thickening layer of the primitive, freely produced cell, which forms the basis of the developing organism, must be the commencement of the enveloping membrane; it is produced whilst the cell, constantly increasing in volume, has its space repeatedly divided into smaller compartments by fold-formation of its inner layer (the primordial sac).

Each of the cells thus produced is supposed to secrete the connective mass (intercellular substance) which unites them into a coherent tissue, just as the various layers of which the cell-wall consists are secreted externally and internally by the primordial sac.

On the other hand, those histologists who believe that cells do not originate by constriction, but as independent structures within the fluid contents of the mother cell, and who are convinced that, along with the production of laminæ by the assimilative faculty of the cell-wall, there is also a simultaneous chemical change, and in many cases a remarkable regeneration of the mother cell by the endogenous development of daughter cells—such observers dissent from the previous views regarding the origin of intercellular substance only so far as to assume that the growth of laminæ does not arise from an excretion of the original cell-membrane (the primordial sac), but by intussusception into its mass. They also conceive that the intercellular substance, which is doubtless present in the interspaces of the active cells, was at one time the outermost cell-membrane or layer of a cell-membrane, but that this has become changed by the agency of assimilation in such a manner that it is subjected to the solvent power of the nutritive fluid which soaks the vegetable tissue and becomes received into its mass.

The explanation of the origin of the membranous envelope (cuticle) as an excretion of the epidermis does not harmonize with the visible peculiarities of this lamina as pointed out by Brongniart, who describes it as a delicate homogeneous covering of the epidermis; for should the laminæ of the cell-wall, together with the cuticle, arise simply by excretion from the cells, the homogeneous nature of this membranous investment would be destroyed by the first act of division of the germ-cell, as it would then be secreted first by two and soon afterwards by four or many cells, and finally by the epidermic layer. In accordance with this mode of origin, it would rather have presented a struc-

ture agreeing with the contour of the epidermic cells, such as indeed is possessed by the outermost coat of the epidermis belonging to the epidermic layers, characterized by Mohl as "cuticular layers."

If, however, the homogeneous cuticle, which, when old, may be slightly granular or striated, but which exhibits no cellular structure, is to be regarded as derived from the first excretion-layer of the first cell, we must ascribe to this first excretion-layer the property of appropriating material out of its vicinity; and as it cannot anywhere find materials ready prepared so as to add them to its substance by apposition in the fashion of inorganic growth, we shall further have to attribute to it the property of preparing the necessary materials for itself from heterogeneous matters by virtue of the chemical affinity inherent in its own substance.

To this first excretion-layer of the first cell we must thus ascribe the faculties which ought essentially to belong only to the interior cell, to which it is indebted for its existence. It must possess in itself the properties of the assimilating membrane; it must be, not a mechanically excreted educt of the exuded cell-juice, but a portion of an organized structure, the membrane of an independent cell, within which the enclosed cells have been produced.

With this view the results of the investigation of the developmental history of this structure published by me in 1848 (Bot. Zeitung) perfectly agree.

I ascertained then, and can repeat the experiment with facility at any time, that by means of endosmotic fluids (such as dilute mineral acids, solution of sugar, &c.) a delicate structureless membrane may be detached from the young embryo in its different stages of development in the embryo-sac: the youngest state of this membrane is consequently the membrane of the germinal cell; and it may be demonstrated by the same means to be the outermost coat of all still cambial organs of the plant in course of development.

The objection that a cell cannot so far enlarge itself as to overspread an entire plant, originating from the idea of the growth of the cell-membrane by accretion, is consequently not applicable; for the cell-membrane, and more particularly the cuticle, as already said, cannot increase itself by accretion, the material of which it is composed not being found in solution in its vicinity.

An independent growth of the cuticle, in many cases quite unconnected with the adjoining cell-wall, may be recognized with certainty in the examples referred to at page 423, vol. xiii. and represented in Plate VI. figure 45.

Very commonly, indeed, an intimate reciprocal relation does appear to exist between the cuticle and the neighbouring cells; but this can scarcely ever be regarded as a production of the former from the latter.

Although the want of a cuticle upon the epidermic tissue of the roots, while it occurs upon stems of the same age, might seem to give support to such an explanation, still the cork-formation occurring in the latter immediately after an injury to the cuticle, or the cuticular layers replacing it, may be regarded as giving probability to a directly opposite supposition. And indeed the cuticle is really present at an earlier period than the epidermis.

The peculiar development of the membranes of *Œdogonium* also affords an equally remarkable and interesting proof of the mutual dependence of neighbouring cells. For the horizontal rupture of the integument in a circular form over the adjacent fold of the joint-cell is not to be explained merely by the fact that the extraordinary thickening of the membrane of the joint-cell assimilates to itself all nutritive material, and therefore excretes nothing for the integument. The latter must then always remain thinner at this spot than in other parts,—which, however, is not the case. On the contrary, the cuticle appears to be quite uniform throughout up to the period of the rupture; its rupture is preceded by a disintegration of its substance, almost appearing as if it were decomposed into a deliquescent mucilaginous and an insoluble granular part, as may be seen especially in the cases described on page 284, vol. xiii. (Pl. V. fig. 25), in which no extension of the joint-cell has taken place.

The conditions observed in *Spirogyra* even lead rather to the supposition that the products of the metamorphosis of the cuticle may serve as nourishment for the adjacent membrane of the joint-cell.

It is true that the *Spirogyræ*, and probably all the Conjugatæ, possess no true cuticle, but the primary membranes of the mother cell fulfil the function of this integument; and the phenomena presented by these may therefore probably be interpreted as analogous to those of cuticular development.

If *Spirogyra orthospira* be allowed to vegetate for some time in distilled water, the very thick cuticular layer is gradually reduced until at last it almost completely disappears, a very thin innermost lamina excepted. In carbonic-acid water this phenomenon takes place still more rapidly, but simultaneously the primary membranes of the joint-cell increase in thickness. On the contrary, if organic compounds be added to the water, the cuticular layer is very perceptibly thickened; the joint-cells cohere more firmly together, and are not separable with the same facility as in the former case.

The most simple explanation of these phenomena appears to me to be, not that the cuticular layer is more or less completely regenerated according as the joint-cells are more or less well supplied with nourishment, but rather that it assimilates the nutritive material present, which reaches it both from without and from within, and transfers this to the inner cells, or, if this nutritive material be wanting, continues the function of nutrition at the expense of its own substance, and is finally destroyed by atrophy, whilst the neighbouring membrane of the joint-cells becomes unusually thickened.

In like manner, also, the developing integumentary cell will probably, up to its complete evolution, possess the faculty of assimilating the nutritive fluids by which it is soaked, until at length, earlier or later according to its specific nature, it serves the assimilating inner tissue as nutritive material, even if this be only as a product of oxidation.

Phases of development similar to those of the cuticle have to be passed through by the different membranes and membranous laminæ of each individual cell-system of which the cellular tissue is composed; the product of the liquefaction of the outermost comes at length to serve as nutritive material for the inner ones which are still living, or for those in course of development in other regions of the organism.

As we know that the cellulose membrane formed by the metamorphosis of the earliest, probably nitrogenous, cell-membrane changes by continual interchange of matter not only into lignine, xylogen, cork-substance, resin, and wax, but also into bassorine, gum, mucilage, and sugar, the notion that the formation of cellulose is the object and result of the interchange of matter in the vegetable cell must be modified as follows:—Many, indeed perhaps most, vegetable cells have to pass through this chemical constitution of their membrane as a necessary phase of their development (a phase, however, which has scarcely been attained or exceeded by many of them when the organism to which they belong has already completed its cycle of life); but in many cases the cellulose cell-membrane employs the fluid by which it is permeated for still further changes of substance.

With this are associated other instances, some of them communicated in the preceding pages, of the independent growth of cell-membranes, and indeed of cellulose cell-membranes (as, for example, the peculiar fold-formation of the primary membrane of the joint-cell of *Œdogonium*, p. 285, vol. xiii., Pl. VII. fig. 49), which are opposed to the notion of the excretion of one cell-membrane by the adjacent ones.

And not only does the membrane of the primary cell undergo chemical metamorphosis and accomplish peculiar changes of

form independently of the neighbouring cell-membranes, but identical or very similar phenomena exhibit themselves in the membrane of the secondary cells, in the production of their "secondary secretion-layers"; for were the layers of cell-membrane known under this appellation only secretions on the inner surface of a primordial sac, this last structure ought to be visible so long as those laminæ are in process of multiplication.

Nevertheless no membrane is ever to be found between the outer and inner so-called secretion-layers possessing the special characters of the primordial sac. On the contrary, I am satisfied, by repeated observations, that the membrane of the secondary cell which is stained by iodine no longer retains its delicate elastic consistence when the internal secretion-layers make their appearance—a fact that favours the supposition that the substance of which the primordial sac is composed furnishes the thickening layers by a change in the character of its activity.

Restricting myself to preceding examples, I would recall to mind the secondary cell of the pollen mother cell of *Althæa*: no primordial sac can ever be discovered between it and the primary cell, and nevertheless its laminar growth is continued for a long time.

There are even instances where such a transformation of the substance of the membrane may without doubt be detected on the coat of the tertiary cell (the cell-nucleus) whilst this membrane is still far removed from the secondary cell-membrane.

In Pl. V. fig. 16 I have represented a cell such as is present in the neighbourhood of the vascular bundles of many Palms, as for example, *Geonoma, Iriartea, Phœnix,* &c. Within the cell-nucleus of this almost cubical cell there is a collection of oxalate of lime in minute crystalline druses, such as are not unfrequently met with in cells. In these cells I found the membrane of the cell-nucleus which lies close upon the secreted crystalline matter transformed into cellulose—a condition which assuredly will be often encountered.

Moreover, in the globules of *Œdogonium* (fig. 50 *b*) all the membranes of the entire system of cells exhibit a cellulose reaction, though this is not the case in the youngest cells of this same plant; consequently a change of these latter into cellulose must also have been effected in this instance.

The nature of the transformation which the several overlying or nested cells of a cell-tissue progressively undergo depends on the position which these cells occupy in the organism; nevertheless the form which their membrane acquires during the interchange of substance does not depend only on this transformation, but in part also on the nature of their contents.

For example, if the cell-contents are organized, and therefore

composed of cell-structures, these usually exercise a perceptible influence on the form of the superadded layers. Both the organized contents and the form of the thickening layers caused by them afford grounds for the discrimination of the different layers that concur in the construction of the cell-system of a tissue-cell.

For as such a cell-system is not only composed of a number of cells, but each of these cells again consists of many superposed layers, it is often difficult to make out the essential nature of any single layer, especially when these laminæ, as not unfrequently happens, are only loosely connected together, or are of dissimilar chemical constitution, or, again, when the membranes of various endogenous cells are of homogeneous consistence, or for other reasons are undistinguishable or inseparable from each other. Under such circumstances it is the rule that the layers of a cell-wall never contain organized bodies; where such are present, the nearest external membrane is the membrane or the innermost lamina of an organized cell.

The layers of deposit may indeed at the time of absorption be separated from each other by fluid materials; but they do not enclose organized forms. On the other hand, many endogenous cells of the system of a tissue-cell contain only fluid, which makes their recognition as cells difficult. Most commonly, however, at least the secondary and the next cells in the interior enclose organized forms.

When, among these organized contents of the secondary cell (consisting of vesicles containing secretion-material and frequently, when the cell is not engaged in the multiplication, of a nucleus), one of these secretion-vesicles becomes so much extended at the expense of the others as to attain the size of the mother cell; the tertiary cell (the cell-nucleus) and the rest of the contents are enclosed between the two membranes, which then become approximated, and from this results the form designated by Unger the "parietal (*wandständiger*) cell-nucleus," which led Schleiden into his above-mentioned erroneous notion of cell-genesis. These forms are developed in fruits which are becoming succulent, as also in cells filled with blue, red, and many kinds of yellow colouring-matter.

But commonly there is a different state of things, the small secretion-vesicles (chlorophyll, starch, mucus, &c.) becoming adherent, during their development, to the internal surface of the membrane of the secondary cell. At a later period, when this membrane begins to undergo a chemical change, and to thicken, these secretory matters become absorbed; the vesicles vanish out of sight, but the spots at which they have adhered, or still may adhere, do not undergo thickening.

The study of the history of development of the porous cells in the pith of *Hoya carnosa*, in the tissue of the stem of *Langsdorffia*, as also that of the porous and scalariform ligneous cells of ferns &c., led me to the knowledge of these conditions of structure*.

At the time it escaped my notice that Unger†, in his instructive examination of the development of the spiral vessels in the root-ends of Monocotyledons, had already arrived at similar results. Unger observed that the youngest vessels arising from the coalescence of series of cells contained a mucilaginous fluid, within which numerous small vesicles soon presented themselves and became adherent to the walls of the vessels, which at a later period underwent thickening, in part in a spiral manner, in the intervals between these vesicles.

A picture of the spiral thickening of secondary cells is furnished by certain diseased states of *Spirogyra nitens*, which have been frequently referred to. When this plant has lain for some time in carbonic-acid water, and is afterwards transferred to pure water or to a very weak endosmotic solution, the chlorophyll-layers are observed to become, in consequence of diosmosis, separated from the swollen secondary walls, as seen in Pl. VII. figs. 65, 66. In these now muco-gelatinous membranes they leave behind them channel-like depressions, the membrane at the parts between them being more strongly thickened, probably from the absence here of impediments to diffusion. The phenomenon is very transitory, as the membrane continues to undergo change by swelling up, and apparently becoming liquefied in the water.

Another picture, likewise, of a spiral arrangement is at times seen in the progress of the changes of the cell-contents of *Mougeotia* when placed in solution of tannin (vol. xiii. p. 418). In this instance the secretion-cells do not adhere to the wall, but occupy the entire cavity of the cell.

Both these examples are probably types of spiral formation as it actually proceeds in nature, though observable with very great difficulty. In every case this formation takes place by means of a thickening of the cell-membrane in the intervals between adherent endogenous vesicles, just as the often observed ridge-like prominences on the secondary pollen mother cells (vol. xiii. p. 483) originate between the pollen-cells, the proper

* De Cella vitali, p. 33, tab. 1. figs. *a–d*; Vegetationsorgane der Palmen, tab. 8. fig. 1 *b*; Bau der Cecropia, Nova Acta, vol. xxiv. tom. I. p. 88, tab. 13. fig. 4; Langsdorffia, Nova Acta, vol. xxvi. tom. II. tab. 63. fig. 5.

† Linnæa, 1841, p. 385, taf. 5. See also Grundz. d. Anat. u. Phys. 1846, pp. 11 & 46.

membranes of which, being subsequently thickened, then appear to be continuations of these ridges.

It is probable that the porous walls are produced sometimes, although but seldom, by mere folds, at other times by thickenings similar to that described in *Spirogyra*, but sometimes also by not only the membrane of the mother cell, but partially those of the vesicles adherent to it, becoming lignified, in the same way as the reticulated outer membrane of spores and pollen-cells and also the simple cellular layer formed by the seed-coverings of the Orchideæ, Burmanniaceæ, Gentianeæ, &c.

That the production of the vessels composed of spiral cells (which are to be regarded as the first vessels in the cambial tissue of the apices of the roots, and therefore, no doubt, also of the buds of the stem and branches) is assisted by the richness of this tissue in organic nitrogenous compounds, was evidenced to me by experiments with roots of *Iriartea*; and that these compounds, by increasing the quantity of the endogenous cellular structures, also appear to induce the general spiral disposition of the organized cell-contents may be assumed from the observations upon the position of the chlorophyll-sac of *Spirogyra* cited at p. 25. Direct special researches will elucidate this point.

Certain retrograde metamorphoses of porous vessels which I have observed appear to me to be capable of furnishing confirmation to the investigations of their anatomical structure made by Unger and myself.

The walls of the thickened porous cells and vessels filled with cork-cells undergo absorption (as described at p. 272, vol. xiii.) in such a manner that the external membranes are the first to disappear. This can be particularly well seen in the much-thickened cells of the medullary sheath, the innermost coats of which, shortly before their complete deliquescence, exhibit pores of considerable size (Pl. V. fig. 15).

Under these circumstances we may not unfrequently detect in the walls of porous vessels in course of absorption a structure which is in accordance with the production of these pores in consequence of the adhesion of vesicles to the inner surface of the cell-membrane which is afterwards porously thickened.

A portion of such a cell-wall, more strongly magnified, is shown in fig. 6. It is composed of almost horizontally disposed annular bodies, imbedded in an intercellular substance, and having interposed between them a homogeneous continuous band cemented to them by the intercellular substance.

That these annular bodies are to be regarded as small cells, thickened strongly all round, and but slightly above and below, is evidenced (leaving out of consideration the already recognized

development of the porous membranes) by the similar aspect of the above-mentioned seed-coats &c. The band visible between them is the membrane of the secondary cell thickened internally in ridges between the small vesicles adherent to it; here it separates readily in a spiral direction from the annular bodies, which now and then detach themselves singly, because the original external lamina from which it grew, and to which the now annularly thickened vesicles adhered, is almost entirely absorbed.

The structure of these vascular walls differs from that of the membranes of seeds and pollen-corpuscles in this respect,—that in the latter the cells are immediately contiguous, and form a continuous tissue, whilst in the former the spherical or expanded vesicles are either completely separated or are in contact in one direction only, though at times an actual coalescence takes place between them.

Since the profound researches of Mohl into the structure of the cell-membrane, it has been known that even heterogeneous layers of deposit occur upon the membranes composing one tissue-cell. This remarkable phenomenon may be simply explained by the fact that in such tissue-cells the heterogeneous membranes of different nested cells are closely approximated.

Moreover the external primary cell-membrane (if we leave out of consideration the spiral texture, which is certainly very prevalent) appears almost constantly to be homogeneous, whilst the membrane of the secondary cell very frequently has a peculiar structure; but the tertiary cell, where it attains the dimensions of the secondary one, is likewise structureless.

The cause of these well-known facts, as also of the parallel occurrence of organized structures in one of the endogenous cells, whilst in others there is only fluid, has not hitherto been recognized.

The frequent and almost normal absence of organized bodies in the contents of the primary cell, and of peculiar forms of thickening of its membrane, throws us back upon its developmental history in order to decide whether this homogeneous external membrane of the vegetable cell is the membrane of the primary cell of the cell-system (as which I regard it) or only the first structureless layer of deposit of the second inner cell-membrane, which subsequently becomes thickened in another form. The latter might then be regarded, with respect to the former, as a primordial sac, if Mohl had not established a different conception of this designation (vol. xiii. p. 268).

The examples already cited (vol. xiii. p. 423, figs. 45 & 49) of the perfectly independent construction of contiguous endogenous cells are not favourable to the last-mentioned conception of the

matter; and in any case we should have to assume in each cell-system, not a single primordial sac, but as many of these as there are of superimposed cells (*e. g.* figs. 51 & 52, 80–85), even if it were permissible, in opposition to the idea set up by the founder of this theory, to give the name of the primordial sac to that layer of the cell-wall which is the last to give up its original peculiarity.

In this case the denomination employed by me for the tissue-cell, of "a cell-system consisting of cells nested one within the other," might be altered into "a tissue-cell consisting of primordial sacs nested one within the other."

Just as the organism requires the complete, normal, endogenous, serial development and the harmonious cooperation of all its elementary organs, for the perfect unfolding of its typical form and functions, the normal structure and activity of each of these elementary organs depends upon the undisturbed development of all these simple organizations, which stand in an intimate reciprocal relation to each other, the cells engaged in a constant interchange of materials, with a structureless spherical envelope and heterogeneous unorganized contents produced in the plastic juice of the mother cell.

It is only in the duration of the reciprocal action of the contents and membrane—the two constantly changing constituents of the cell—that its organization consists. An absolute stoppage of the change of materials of all its parts is coincident with the cessation of the organizatorial activity of the organism.

The opposite idea—namely that the secretion-structure, the cellulose membrane, just as the calcareous shell is the house of the snail, forms the chamber into which plant-life retires, the house of the plant-cell, and afterwards its tomb—would become, if it found acceptance, the winding-sheet of science.

XXI.—*On a new Generic Type of Fishes discovered by the late* Dr. Leichardt *in Queensland.* By Albert Günther, M.A., M.D., Ph.D.

[Plate VII.]

Sir Daniel Cooper, Sir Philip G. Egerton, and Mr. G. Krefft have favoured me with photographs of a fish obtained by the late Dr. Leichardt in the Burdekin River, which evidently is the type of a new and remarkable genus. The specimen from which the photographs were taken is a dry skin, 15 inches long, preserved in the Australian Museum at Sydney. The photograph sent by Sir P. Egerton was accompanied by a scale taken from the middle of the side of the Sydney specimen, and shows a structure very similar to that of the scales of the

African genus *Heterotis*. These materials alone appeared almost sufficient to assign to the new fish its systematic position in the neighbourhood of *Chirocentrus* or *Heterotis*, when, to my great satisfaction, a second specimen was found in the collection of the British Museum. It had been sent by the unfortunate Mr. Gilbert as a specimen collected by Leichardt; and it may have been obtained at the same place and time as that in the Sydney Museum; it is also stuffed, but considerably larger, having a length of 28 inches.

Sir Daniel Cooper informs me that it is probably the same fish which has been caught by Mr. E. F. Hill in a creek at a station called Princhester, 90 miles from Rockhampton: if this be really the case, he hopes to obtain specimens in spirit from this place, by which we may be enabled to settle some interesting points regarding its anatomy, especially the question whether, like *Heterotis*, it is provided with a superbranchial organ.

I proceed to give the description *.

Scleropages.

Body oblong, compressed, covered with large scales; belly longitudinally keeled; head compressed, infraorbital bones much enlarged, covering the cheek entirely; cleft of the mouth very wide, with the lower jaw prominent; coarse cardiform teeth in both jaws and on the palate. Dorsal fin of moderate length, opposite the hind part of the anal, which is elongate; pectorals well developed; ventrals small.

Scleropages Leichardti. Plate VII.

D. 20. A. 31. P. 9. V. 5. L. lat. 35. L. transv. 3/4.

The height of the body is rather more than the length of the head, which is contained thrice and three-quarters in the total (without caudal); the upper profile, from the dorsal fin to the snout, is nearly straight, whilst the lower is curved upwards from the subthoracic region. The cleft of the mouth is oblique, very wide, extending to behind the eye; the mandible is strong, long, nearly two-thirds of the length of the head; it projects beyond the upper jaw, and is furnished with a pair of very small barbels near the symphysis; the intermaxillary is short, and situated at the extremity of the upper jaw, whilst the maxillary forms the side. Both jaws are armed with a series of small, closely-set, conical teeth, equal in size: a band of coarse cardiform teeth runs round the palate; but whether these teeth really belong to

* Whilst this paper was passing through the press, I have found that the genus *Scleropages* is closely allied to, or identical with, *Osteoglossum*. Cf. *O. formosum*, Schleg., from Borneo.

the palatine bones cannot be ascertained, on account of the dry state of the specimen. The snout is short, not much longer than the eye, the diameter of which is one-sixth or one-seventh of the length of the head. The eye is situated immediately below the upper profile of the head; the nostrils are close together, midway between the eye and the extremity of the upper jaw. Interorbital space flat, its width being contained thrice and three-quarters in the length of the head. Cheek very flat and broad, entirely covered by the two posterior infraorbital bones, which extend downwards and backwards to the limb of the præoperculum; they are finely striated, like the operculum. Operculum more than twice as high as long, with the posterior margin rounded and continued into a broad membranous strip. Sub- and inter-operculum very small. The course of the muciferous channels through the bones of the head is indicated by a number of oblong cavities closed by membrane.

The dorsal fin is placed above the hind part of the anal, terminating at no great distance from the caudal; its anterior rays are short, and increase in length to the twelfth, behind which the rays again become shorter. Caudal fin rounded; anal of the same height as the dorsal, the rays about the twenty-fourth being the longest. The first pectoral ray is exceedingly strong, compressed, and nearly as long as the head; however, it does not extend to the very short ventral fin, the base of which corresponds to the eleventh scale of the lateral line.

The scales are very large, higher than long, with the exposed surface minutely granulated, and with a network of fine channels over the inner surface, the meshes being concentrically arranged round a larger mesh in the middle. Each scale of the lateral line is pierced by a single large elliptical hole.

The entire body is finely dotted with brown; vertical fins and opercular membrane with small whitish spots.

XXII.—*Description of a new Species of* Callionymus *from Australia.* By Dr. Albert Günther.

Callionymus Papilio.

This species belongs to the group with the gill-opening reduced to a small foramen on the upper side of the neck, and with the lateral line single.

D. 4 | 7. A. 6. C. 11.

Præopercular spine considerably shorter than the head, bifid at its extremity, both points being directed upwards. The rays of the vertical fins long, those of the second dorsal longer than those of the first, and nearly equal in length to the middle caudal

rays, which are not quite half as long as the body: the last anal ray prolonged. The ventral fin extends beyond the origin of the anal. Body light brownish, marbled with darker; the lower part of the sides of the trunk and tail with numerous pearl-coloured vertical lines; belly pearl-coloured. Sides of the head with numerous small white ocelli edged with violet. Both dorsal fins with large, rather irregular, rounded whitish spots, each with a narrow violet edge; there are fine white dark-edged lines and dots within the large spots; a narrow, black, blue-edged spot behind the extremity of the first dorsal spine. Caudal and pectoral fins with white dots, which are mixed with brown ones on the lower half of the caudal. Oblique pearl-coloured lines behind each anal ray.

Melbourne. The description is taken from a male specimen, 5 inches long.

XXIII.—*On the Structure of* Antipathes. By M. Lacaze-Duthiers*.

Two species form the subject of this memoir—namely, *Antipathes subpinnata* and *A. Larix* (Esper, Lamarck). Of all the Corals, they are the most difficult to investigate; and no doubt it is on this account that we have so little precise information about them. They live at great depths, and are only brought up by those coral-fishers who work upon the rocks. They are formed of so delicate a tissue that the shortest exposure to the air is sufficient to dry them up; and as it is only with great trouble that the fishers can be persuaded to keep them in water while they are at sea, the naturalist has much difficulty in obtaining them in a fit state for examination.

In the two species which I have observed living, the polypes are regularly arranged in a line upon one side only of the branches—namely the upper surface, or that which is opposite to the attachment of the polypary.

Each animal, as observed by Ellis, Solander, and Dana, has six tentacles, arranged in a rosette round the mouth. These tentacles do not appear to elongate themselves much; most frequently they seemed to be merely six large tubercles; but, perhaps, in the normal condition at the bottom of the sea the elongation may be greater. The body does not rise into a tube projecting above the sarcosoma, but only forms a mamilla: in this respect it is very different from that of *Gerardia*.

The diameter of the rosette of the largest polype in *A. subpinnata* does not exceed 1 millim., and it is larger than that of *A. Larix*. Judging from the observations which can be made

* Translated from the 'Comptes Rendus' for July 25, 1864.

in the collection of the Museum, there must exist great differences in the size of the polypes in the different species—as, for instance, in *Antipathes scoparia*, Lamarck, and *A. glaberrima*, Esper (*Leiopathes glaberrima*, G.). When the tentacles are contracted, the polype only forms a large mamilla, upon which no traces of the tentacles are to be distinguished. In many dried specimens, however, we may see six tubercles surrounding the mouth, which forms a seventh.

The general cavity of the body in *A. subpinnata* presents a very remarkable arrangement, which has nothing analogous to it in any known Coral. When the peristome is examined, six lines are seen radiating around the mouth; these evidently correspond with the peripheral septa which are known to exist in all these animals; but four of the lines become effaced not far from the mouth, in the midst of the tissues. Two larger ones, opposite to each other, alone bear the convoluted filaments; these two septa are usually in the plane passing through the axis of that portion of the polypary which bears the animal to which they belong.

This arrangement is very remarkable. In investigating the development of the *Actiniæ*, we find that the formation of the peripheral chambers of the general cavity commences by the production of two septa, which, retaining the advance that they have before the rest, always appear to be more developed, and correspond to the angles of the commissures of the mouth. In *Antipathes* these first two septa alone appear to attain complete development; the others are scarcely indicated by the lines above mentioned.

In these, as in other Coral-polypes, we find an œsophagus leading from the mouth, upon which the inner margins of these two septa are attached. It must also be observed that the convoluted body, which is of comparatively very large size, appears to occupy the whole of the free margin of the septum.

The tissue of the walls of the body is of extreme delicacy. It is composed of two sets of cells, in which two distinct layers are not, as in *Gerardia*, to be recognized. Of these cells some are transparent and turgid with fluid, others opaque and filled with granulations. The latter, by bursting and mixing their contents with the water, give origin to a viscid mucilage, which is very troublesome in making preparations. The cellular tissue is covered with very active vibratile cilia, both within and without.

The nematocysts are ovoid, and of large size. Their thread is short, and its spiral turns are but indistinctly visible through the capsule. They are largest in the convoluted filaments, and are there regularly arranged almost side by side. In the integuments they are grouped in parcels, as in *Gerardia*.

The *Antipathes Larix* which I had in my possession had its convolutions crammed with corpuscles resembling in transparency and tint the testicular capsules of *Gerardia*. If it were not rash to come to any conclusion from observations made on objects not in the best possible state, I should say that the sexes are separate, and borne not only by distinct polypes, but even upon distinct polyparies. But I cannot generalize and assert that this is always the case.

The polypary of the true *Antipathes* bristles all over with spinules. These have not escaped other writers, but some of them have erroneously regarded them as abortive branches. The arrangement of these spines may furnish useful characters for the discrimination of the species.

The sarcosoma everywhere covers the polypary, which appears as if enclosed in a sort of distinct sheath. When it contracts, its tissue is traversed by the spicules, as is the case in the *Gorgoniæ*.

The growth of the polypary takes place by the deposition of layers which are superimposed upon the stems, and which at the extremities resemble the fingers of gloves enclosed one within the other. The centre of the axis appears to be perforated by a canal; but this is only an appearance due, in fresh individuals, to the inferior density of the substance which has been added at the extremities and become internal, and, in dried specimens, to the contraction of this substance.

Between *Gerardia* and *Antipathes* there are great differences. In the former the polypary is smooth and covered with very small and scarcely sensible umbilicated elevations; in *Antipathes* it is covered with spinules. The twenty-four tentacles of *Gerardia* correspond with as many chambers separated by the same number of septa with convoluted filaments; in *Antipathes* only two of these convoluted cords are developed, and the tentacles are never more than six in number. In *Gerardia* the Actinian type is as highly developed and characterized as possible; in *Antipathes* it remains incomplete, in consequence of a sort of arrest of development.

XXIV.—*On Clays, containing Fossils, near St. Andrews; with Remarks on some of the latter.* By Robert Walker.

The Clay-bed whose geological position and fossil contents are about to be noticed is situated near the mouth of the Kinness Burn, or rivulet, a small stream that runs past St. Andrews on the south side. Towards the sea this stream has eroded its channel about three feet through the bed. At one time the clay could be seen forming part of the bank on each side of the

burn; but, from recent alterations, it can now be seen only on the north side, and there to a limited extent. Taking the utmost stretch of this deposit, it appears not to occupy a superficial area of more than 100 yards each way. Although thus contracted, there is reason to think that it may be the remnant of a more extensive bed which the action of the sea had reduced to its present diminutive dimensions ages ago, when the relative levels of land and sea, and perhaps the outline of the coast, were somewhat different from what they are now. This clay has been known for years to contain shells; little notice, however, appears to have been taken of it beyond occasionally picking out a few *Scrobiculariæ* as they were washed bare by the burn. In this state the matter remained till about two years ago, when the proprietor cut a water-course and a pit for a mill-wheel through the deposit, on the south side of the burn. Although these excavations were not very extensive, they resulted in the turning up of a number of marine shells and some mammalian bones, which had the effect of directing attention more particularly to the subject. A short time afterwards, during the sinking of a well opposite the former excavation, but further from the edge of the burn, a considerable number of shells of different species were again observed. This well was dug 9 feet deep, and the section taken as accurately as possible. In order, however, to test the strata as far as the condition of things would allow, another pit was dug for this purpose, still further from the burn, and higher above the level of the sea than either of the previous excavations, the surface of the ground at this part being about 10 feet above the sea-level.

The following section is from the latter of these pits; and it may be observed that the only appreciable difference between the two sections was in the second bed of the former being somewhat thinner than that of the latter, owing, perhaps, to its proximity to the burn, by which the sand and gravel might have been washed away before the stream cut out its present channel:—

	feet.	inches.
1. Black vegetable earth	1	6
2. Coarse sand, numerous small rolled stones, and littoral shells	2	6
3. Brown sandy clay, few stones or shells	1	4
4. Bluish-brown clay, with here and there thin partings of fine white sand; shells plentiful; the bed not cut through	4	9

The contents of the second bed corresponded in every respect with the materials on the sands at the east of the town at the present day. The contained shells were chiefly *Patella vulgata*,

P. pellucida, Littorina littoralis, L. littorea, and many broken fragments of other littoral shells. The third bed, although distinct enough, seems to be merely a mixture of the materials of the second and fourth beds; the only shells observed were a few straggling specimens of *Littorina.* In composition, the fourth bed has a greater resemblance to estuary silt than to any other kind of deposit: it shows no traces of lamination, and, with the exception of occasional thin layers of sand, it bears no other marks of stratification. From this bed the mammalian bones and the following shells were obtained; the latter seemed to be distributed through the mass, as far as it was pierced. Of the bivalve shells, the most common was *Tellina proxima,* of which specimens of all sizes were in abundance; and, as usual with this species, the valves were covered with a yellow epidermis, which in most cases, however, adhered more firmly to the clay than to the shell. There were likewise a considerable number of specimens of *Scrobicularia piperata, Mytilus edulis, Cardium edule,* and two or three examples of *Saxicava rugosa.* Of the univalves, *Rissoa ulvæ* was in the greatest abundance—in some places completely crowded, more especially where there was a lamina of sand. *Littorina littorea* was plentiful; there were two specimens of *Nassa incrassata,* and two or three of *Helix hispida.* The univalves were all full-grown specimens; but none of the bivalves, with the exception of *Scrobicularia* and *Tellina,* had attained full dimensions. They were all very friable, and in the case of *Mytilus* and *Cardium* it was scarcely possible, in many instances, to remove them from the clay without breaking. In every instance both valves were adherent; and there can be no doubt whatever that the animals lived and died where their shells were afterwards found. All the marine shells of the preceding list are living in the littoral zone of the adjacent sea, with the exception of *Tellina proxima,* which does not appear to be living now in any part of the British seas, and is considered a characteristic shell of the glacial deposits of Scotland; they are all included in Geikie's Catalogue of Organic Remains from the Glacial Deposits of Scotland*; they are likewise included in Wood's 'Mollusca of the Crag;' so that as species they must have existed during many of the physical changes that have occurred on the earth toward the latter epochs of its history.

Of vegetable remains noticed, there were pieces of the branches of the birch and the oak, together with a few nuts of the latter. Of the birch-branches, however, there was little else than the bark preserved, which did not appear to be at all wasted. There were also a few fragmentary impressions of leaves, and many impressions and remains of what appeared to have been marsh-

* The Glacial Drift of Scotland.

plants, with some of the stems in an upright position. There were likewise numerous fibres and rootlets of seemingly various plants. These rootlets and impressions clearly indicate that marshy and perhaps other plants had at one time grown in abundance on this bed; and, so far as observed, this would appear to have been before the third bed was laid down, as no rootlets or stems could be seen in that deposit; and there seems no reason why they should not have been preserved, or traces of them, in the one bed as well as in the other, if they had ever been there. No doubt, from the littoral character of the shells found in this bed, some of them could exist although they were not many feet under water at every tide. Some of the *Tellinæ* can live high upon the muddy shores of estuaries; so can *Scrobicularia*. And, from the large size of these species, it may be inferred that they had found a more congenial habitat than seems to have been the case with *Mytilus* and *Cardium*, whose size and thickness might at the same time be somewhat influenced by the freshness of the water. The three latter species can undoubtedly live in places where the water is as often fresh as salt. Jeffreys says* that the Mussel and the common Periwinkle (*Littorina littorea*) are occasionally found living on the shore in a stream of perfectly fresh water during the recess of the tide, that *Cardium edule* has the same habit, and that the latter species even occurs associated with freshwater Mollusca. It is well known, from the writings of Montagu and others, that *Scrobicularia piperata* burrows in muddy places that are occasionally covered with fresh water, at the mouths of rivers, or far up estuaries. So far as my own observations go, the shell of the latter species retains nearly its normal size and thickness in places where neither *Cardium* nor *Mytilus* seem capable of existing, or, if met with, are always in a thin and dwarfed state. However, there can be no doubt that all the foregoing species could not have lived in situations so high above the sea as to allow even marshy plants to grow. This being the case, the plants must have grown after the bed was raised a few feet higher above the water. For this purpose one of two causes would be necessary: either the land at this time was slowly rising, or the estuary was gradually silted up: perhaps both these operations were going on at the same time, although it would be impossible in the present instance to say which had the chief hand in the matter. At the same time that the land was elevated to some extent, there seems no room to doubt (indeed, according to the observations of Geikie† and others, there appear good reasons for believing) that the land on many other

* British Conchology, vol. ii.

† The Glacial Drift of Scotland.

parts of the coast was gradually rising during the deposition of these shell-clays. Whatever may have been the agents engaged in laying down this deposit, whether it has partly resulted from the effect of the waves beating upon exposed banks of boulder-clay, or from the mud borne from the land by glaciers or coast-ice (as suggested by Geikie* to account for the formation of the shell-clays of the west coast), or (what at first sight might perhaps appear equally probable) from the quantity of mud and sand carried down by the Kinness Burn—in either case, the three latter forces all indicate a very different condition of climate from what now prevails in these latitudes: the quantity of water in the burn is now so small; and besides it drains such a limited district that, under the present conditions, its volume could never have been much greater than it is at present. Unless we suppose (as indeed seems probable) that, during the close of the glacial period, it was flooded every summer by the melting of the snow and ice that had collected throughout the preceding winters, it would be difficult to conceive how this small stream could have acted any part in the matter—much less to suppose that, in its present volume, it could have eroded and transported sufficient material to form the accumulation in its present extent, irrespective of what may have been washed away at a later period. This will be more apparent when it is stated that some years ago a pit was sunk into this deposit to the depth of 14 or 15 feet, and the stratum afterwards bored to the depth of 60 feet additional, in search of water, without finding any. This pit was about 40 yards south of the place that yielded the present organic remains, and about 20 feet above the sea. The contractor assures me that during these operations the clay was found to be of a bluish-grey colour, as far as pierced; from which it may be inferred that the bottom of the stratum was not then reached.

From the thickness of this clay, it is evident that a considerable portion of it must be many feet below the sea-level. It would likewise appear to have been deposited in a hollow scooped out of the boulder-clay. The latter can be seen a little further down the stream, extending apparently from beneath the blue clay to the "east sands," where it is occasionally swept bare by the waves from high-water mark to a considerable distance seaward. When thus exposed, the irregular appearance of its surface, and the numerous rolled stones of many sorts and sizes projecting out of the mass, show clearly the unmistakeable characteristics of the boulder-clay. It may be remarked that this is the only place where the boulder-clay can be seen in the immediate neighbourhood. A few years since, it was well ex-

* The Glacial Drift of Scotland.

posed, during the excavations for a gas-holder, close by the harbour, about 40 yards further down the burn than the spot where the fossils were obtained.

All the other excavations, of late years, made for building and other purposes, along the high ground by the south side of St. Andrews, have merely exposed the brick-clay, which, like the boulder-clay, is of a red colour and of considerable thickness, sweeping down both sides of the Kinness valley. On the high ground there are alternate beds of fine sand and clay; some of the sand-beds are about two feet thick, and sometimes show curious contortions. Though organic remains are not common in these beds, I have sometimes, after a diligent search, found fragments of both bivalve and univalve shells; on one occasion I discovered stalks of an *Equisetum* sticking in an upright position in the clay, 9 feet from the surface, seemingly as they had grown, on a thin layer of vegetable matter. About a year ago, in the cutting of a deep drain through this clay, by the side of the burn, but about a quarter of a mile up from the shell-clay, there was part of the trunk of an oak-tree turned out, which had been deposited in the clay with the branches and acorns. From the profusion of the latter, and their evident attachment to the branches when imbedded, it would appear that the tree had grown at no great distance, and that it had been swept down in autumn. There were also fragments of the birch; and from a bed of drift-gravel intercalated with the clay, the molar tooth of a horse and a molar of a goat were obtained.

The brick-clay is laid thick along both sides of the valley, and can be distinctly traced to within a few yards of the blue or shell-clay. And, although the junction of these strata cannot be satisfactorily seen, from the ground being under cultivation and no section exposed, still it can hardly be disputed (from the position of the beds and the nature of the ground) that the brick-clay underlies the blue clay to some extent on the landward side of the latter. This would precisely agree with the relative positions of the shell- and brick-clays on the west coast, according to Mr. Geikie*. He says, "The red brick-clay sometimes dwindles down to only a few inches in thickness, but is always found between the shell-clay and the hard till" (boulder-clay). From the position and fossil contents of the blue clay in question, there seems little reason to doubt that it is the representative on our east coast, though fragmentary, of the more extensive and prolific shell-clays of the west, and that, like them, it was deposited during the close of the glacial period, while characteristic shells of that period, such as *Tellina proxima,* still lived in abundance on the British shores. Over this glacial bed,

* The Glacial Drift of Scotland.

marsh- and perhaps other plants had grown and decayed (how long, it would be impossible to conjecture) before the land again began to sink under the sea; during which time the deposit would be exposed to the tear and wear of the waves, when doubtless many of the organisms, together with a great portion of the bed itself, would be washed away. It would be difficult to ascertain, from the manner in which the third and second beds seem to have been deposited, to what extent the land subsided at the time, and whether the subsidence was gradual or rapid. The continuation of the latter of these beds has been noticed at other places in the neighbourhood, at greater elevations. For instance, in a cutting to divert a small stream on the farm of St. Nicholas, about half a mile south of the clay, this littoral deposit was passed through: here it is from 12 to 15 inches in thickness; and the composition and contained fossils are identical with the second bed of the section. At this part the deposit is laid upon a gentle declivity arching round to the Kinness valley, and from 27 to 30 feet above the sea, thus occupying an intermediate position between Dr. Chambers's 64-feet beach at this place and the sea-level; he states, however, that here "the sea has made several shifts of level without indenting the land"*. This stratum was likewise exposed, on the north side of the Kinness valley, about three years since, while altering a wall at the gas-works, at an elevation of 35 feet above the sea, the ground sloping towards the south. This bed was again laid open by the present drainage-excavations; but this time it was on the west side of St. Andrews, at the height of 21 feet above the sea, and contained all the littoral shells enumerated in our second bed.

Besides the preceding, there is additional evidence, though of a different kind, of the sea having stood at a higher level than at present, in *recent* times, geologically speaking. This is furnished by an isolated patch of sandstone that crops out at the south end of the "west sands" being quite full of the holes of *Pholas crispata*. This rock is within a foot or two of high-water mark, and about 14 feet above the habitat of the *Pholas* at the present day, which generally lives between 2 to 3 feet above low-water mark and a few fathoms beyond. They do not appear from choice to make their habitations in sandstone, but rather prefer shale or limestone, if these rocks can be had at suitable depths. From the numerous borings in the sandstone in question, it would seem that it had continued for a long time at a depth in the water favourable to the organization of these mollusks; and as the land was gradually elevated, they appear, from their holes still visible here and there in the intervening rocks,

* Ancient Sea Margins.

to have slowly fallen back to their present station. Additional evidence might be given, from the strata on other parts of the coast, as well as on the authority of various observers, which would go far to show that these recent oscillations of the land had partaken much more of a general than of a local character. The present object, however, is mainly to endeavour to define the geological position of the shell-clay of this district, and to prove, as far as possible from the evidence borne by the strata of the immediate neighbourhood, that the land on this part of the coast had subsided many feet after marshy plants had grown apparently in abundance on these glacial beds.

The Mammalian bones already referred to as found in the lower bed, associated with the shells, comprise some bones of an ox and a horse. The remains of the ox (*Bos longifrons*) consist of the frontal bones and horn-cores: the latter are a little larger than those described by Prof. Owen; otherwise there is no difference between them and the description and measurements of this species given in the 'Fossil Mammals.' The bones of the horse consist of part of the cranium, the left tibia, the os calcis of the right side, and a hoof-phalanx. The skeleton seems to have been complete at the time it was discovered; and it is much to be regretted that, owing to its lying on one side of the trench, the rest of the bones were not dug up, in order to allow a more complete comparison between them and the skeleton of the recent species. At the same time, the result of a comparison of these fragmentary remains with the bones of the horse of the present day may not be unworthy of a little notice.

This portion of the skull comprises the superior maxillary, the intermaxillary, the malar, and part of the lachrymal bones, along with a part of the palatine bone of the right side, of the left side, the greater part of the intermaxillary, and the palatal portion of the superior maxillary. All the teeth of the right upper jaw, and the two middle incisors, the canine, and the second molar of the left upper jaw are likewise present. This cranium had belonged to a horse (judging from the condition of the incisor teeth) of not less than six or seven years of age. The respective bones do not differ in shape from the corresponding bones of the recent horse; neither do the grinding-surfaces of the teeth differ, except in the last molar, the enamel and dentine folds being very similar in both. The molar teeth differ, however, from those of the horse of the present day, in the first molar having a less acute anterior angle, and in the smaller transverse diameter of the second and third molars compared with their antero-posterior diameter. So far these characters agree with those of *Equus fossilis*; but the last molar differs

from the heretofore recognized characters of the last tooth of that species in having a bilobed posterior termination, apparently agreeing in this respect with the last molar of *E. plicidens*; the enamel and dentine folds, however, extend across the crown, like those of the last molar of *E. fossilis* as figured in the 'Fossil Mammals.' It has been observed by Prof. Owen long ago, that the fossil horse had proportionally a larger head than obtains in the domesticated races. While this is, no doubt, the case to a considerable degree, still, were we to assume that the fossil horse had as large a head as the recent, in proportion to the size of the molar teeth (which, in the case of the former, are often found detached), we should be somewhat mistaken. At least, in the fossil under consideration, the majority of the teeth are nearly as large as the teeth of the cart-horse of the present time, while the head itself has evidently been a good deal less. However, to show the relative sizes more clearly, I will, as far as practicable, give the measurements of the fossil cranium, the molar teeth, and the tibia, together with similar measurements of a Scottish pony and a cart-horse, the latter appearing to me to be a fair representative of its class:—

	Scottish pony. inches.	Fossil. inches.	Cart-horse. inches.
Length of the intermaxillary bone (measured over the curve) from the edge of the alveolar cavity of the first or middle incisor to the termination of the ascending apophyses	$7\frac{1}{4}$	$8\frac{1}{8}$	$9\frac{1}{4}$
From the anterior edge, in front of the canine tooth of the superior maxillary, in a straight line to the orbital cavity	$9\frac{3}{8}$	$10\frac{1}{4}$	$12\frac{1}{2}$
Breadth of the superior maxillary, from the anterior edge of the first molar to the upper edge, at the point where the intermaxillary bone terminates	$3\frac{3}{4}$	$4\frac{1}{8}$	$4\frac{1}{2}$
Dimensions of the molar teeth.			
Antero-posterior diameter of the crown of the first molar	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$
Antero-posterior diameter of second molar..	1	$1\frac{3}{16}$	$1\frac{3}{16}$
,, ,, third molar ..	$\frac{7}{8}\frac{1}{16}$	$1\frac{2}{16}$	$1\frac{3}{16}$
,, ,, fourth molar..	$\frac{3}{4}\frac{1}{16}$	1	$1\frac{1}{16}$
,, ,, fifth molar....	$\frac{3}{4}\frac{1}{16}$	$1\frac{1}{16}$	$1\frac{2}{16}$
,, ,, sixth molar ..	$1\frac{1}{16}$	$1\frac{2}{16}$	$1\frac{1}{4}\frac{1}{16}$
	$5\frac{7}{8}$	$6\frac{7}{8}$	$7\frac{3}{8}$
Dimensions of tibia.			
Extreme length, including tibial spine or central process in the knee-joint........	$13\frac{1}{4}$	$13\frac{5}{8}$	16
Greatest transverse diameter of the head ..	$3\frac{3}{4}$	$3\frac{5}{8}$	$4\frac{7}{8}$
,, ,, of the distal end	3	$2\frac{7}{8}$	$3\frac{7}{8}$
Least circumference of the shaft..........	$4\frac{5}{8}$	$4\frac{3}{8}$	$6\frac{1}{2}$

The foregoing dimensions will show the different sizes of the teeth and bones. And as the length of the tibia (minus the central process in the knee-joint) in general averages one-fourth of the height of the horse to which it belongs, in this way a fair approximation to the sizes of the animals under consideration may be obtained. It will be observed, taking the measurements of the crania from the anterior edge of the superior maxillary to the orbital cavity, that this part in the fossil is $\frac{7}{8}$ inch longer than that of the pony, and $2\frac{1}{2}$ inches shorter than the same part in the cart-horse. As this part of the horse's skull is on an average about 1 inch longer than the space from the anterior margin of the orbital cavity to over the occipital condyles, it will be apparent that, if we make a proportional allowance for this part, absent in the fossil, and of course add for the fore part of the intermaxillary bone, we shall not be far wrong in estimating the fossil skull at 2 inches longer than the pony's, and about 5 inches shorter than the skull of the cart-horse; while it will be seen that, taking the total of the antero-posterior diameter of the molars, irrespective of details, these organs in the fossil exceed those of the pony by 1 inch, and are only $\frac{1}{2}$ inch less than those of the cart-horse.

XXV.—*Some Remarks on the Succession and Development of Animal Organization on the Surface of our Globe, in the different Periods of its Existence.* By J. Van der Hoeven, Professor of Zoology, University of Leyden*.

It requires but little knowledge of organized bodies to remark that there is a great difference in their structure, and that some are more, others less complicated. This greater development depends not only on the presence of parts or organs which are absent in more simple organisms, but also on modifications in the structure of parts which exist as well in more simple as in more perfect species. In the animal kingdom, for instance, there are species which are devoid of the organs of the senses of sight and of hearing, so important in man; others which have these organs, but in a very different degree of complication. Thus the organ of hearing presents a greater number of distinct parts in mammals than in fishes; and thus, too, the eye is in general more complicated, more moveable, more nicely protected in the former than in the latter. It is needless to give a larger number of examples of this diversity of perfection. From the observation of this diversity originated a conception which seems

* Written in Dutch, in 1858, before the publication of Mr. Darwin's work. Communicated by Dr. J. Barnard Davis, F.S.A.

to have a great charm for the minds of most persons, that there is an unbroken chain of progression in all the productions of organized nature, and that there is an imperceptible transition from the one to the other, all being connected, without any jump*. It would not be difficult to refute many of the proofs which are often brought forward in favour of this connected series; but this refutation could have no other value than that of evincing that the examples were ill-chosen and delusive. It will be sufficient to remark that the existence of such an uninterrupted ladder is by no means a necessary consequence of the incontestable diversity in complication and perfection of the organisms, and that there can be degrees of perfection without an imperceptible transition from one to the other.

The conception of an uninterrupted ascending series assumes a very different character when it is connected with the opinion that there is really such an evolution from the most simple beings to the highest organisms. Many authors use the word "evolution," or development in the different divisions of the animal and vegetable kingdoms, only in a metaphorical sense; but others believe that there is really such a gradation, and that the great variety of organic bodies originates in a succession of developments. According to these authors, a more complicated organism is the descendant of another not so complicated, and this organism, again, was the offspring of a still more simple one; and in this manner, by a continuous progression from step to step, we arrive at last at unicellular forms, as the original prototypes and progenitors of the whole animal and vegetable kingdoms. In this conception the transitions ought to be altogether complete, and it seems that even the smallest chasm cannot exist. If it appears that there are, nevertheless, such chasms, it must be surmised that many living species still escape our researches, and our imperfect knowledge is the only reason of this apparent discontinuity—or that these connecting links existed formerly, but are now destroyed by some revolutions in the condition of the globe, and thus removed from our actual observation.

If we withdraw from the bright field of inquiry which is illumined by observation, and deviate into the gloomy labyrinths of opinion, it is not uncommon to behold all sorts of representations, which assume other forms and dissolve away like the confused outlines of the clouds. It is in this manner alone that we find an explanation of the arbitrary conceptions proposed by some authors, as if they were events of the history of creation. Amongst the authors who are the adherents and advocates of such an evolution of organisms as I allude to, a first place ought

* It was principally Charles Bonnet who enlarged upon this scheme, and extended the conception to the universe.

to be given to De Maillet, who lived at the end of the 17th and beginning of the 18th centuries, and was French consul in Egypt and afterwards at Palermo. His opinions are explained in a book entitled 'Telliamed, ou Entretiens d'un Philosophe Indien avec un Missionnaire François sur la Diminution de la Mer, la Formation de la Terre, l'Origine de l'Homme, etc.'*

From the supposition that animals now living and plants growing on the land all originated from organisms living in the sea, he endeavours to establish that all forms occurring among animals and plants on the continent have their representatives and corresponding species in the ocean. Birds are to be derived from flying-fishes, which, entangled by accident between the reeds, were prevented from returning to their former abode. Their fins were cloven, their rays were clothed with feathers, and the ventral fins were transformed into legs. "Il se fit encore d'autres très-petits changements dans leur figure. Le bec et le col des uns s'allongèrent, et des autres se raccourcirent. Il en fut de même au reste du corps. Cependant la conformité de la première figure subsiste dans le total, et elle est et sera toujours aisé à reconnoître" (pp. 320, 321). It is hardly necessary to say that such conceptions are inconsistent with calm and unprepossessed inquiry, and are dissipated by its touchstone.

Provided with a larger knowledge of natural history, the French naturalist Lamarck was, at the beginning of our century, the warm defender of similar views. He believed that there is a slow development, by which, from the most simple infusorium, originate different other animals, till the highest forms are attained. If all animals were confined to the same conditions, the same medium, the same temperature, and the same external circumstances, this ladder of development would be uniform and very regular. This would be the case if, for instance, there were only marine animals living at the same depth and in the same temperature. But such not being the fact, another agent steps in, in addition to that of gradation—the influence of external conditions, their relation to the wants and acts of animals, which, by constant repetition, produce habits. These habits modify the organization. Some parts, being more constantly used, increase in bulk and strength; others, by rest and inaction, lose their importance, are reduced in size, or disappear entirely. So habits form new organs, as, he says, is generally known, because it gave rise to the proverbial expression, "Les habitudes forment une nouvelle nature."† Even passions pro-

* There are various editions of this book. I have that published at Basle, 1749, in small 8vo. "Telliamed" is an anagram of the author's name.

† Philosophie Zoologique, par J. B. P. A. Lamarck. Paris, 1809. 2 vols. 8vo. See vol. i. p. 237.

duce such alterations. Lamarck thinks it very probable that fits of anger in Ruminants produce congestions in the forehead, and that, by striking each other when they fight, a greater secretion of osseous substance and a production of horny matter might be provoked, by which means they at last acquired horns*.

It would be difficult to adduce decisive proofs of facts that these and similar modifications originate in such manner. The advocates of these hypotheses point to the very limited time wherein it is allowed to man to contemplate the productions of the forming power of nature. How different would be our conception, if we were in the possession of an experience of several thousand years! Are these theories illustrated by the remains of animals which are imbedded in the many different strata of the crust of the earth? This question, at all events, deserves to be discussed.

The fossil remains of organic bodies gave occasion in former times to very different opinions. Some believed them to be only productions of a sporting Nature—mere *lusus naturæ*—remarkable representations of plants and animals, but which never were true living organisms. Others, not mistaking their true nature, believed that all these fossils were the remains of organic beings destroyed by a great flood, the deluge recorded in the book of Genesis. A further and closer examination of these remains proved, more and more, that they could not have belonged to the same period, and that there was as great a diversity between those of different strata as between these in general and the now living animal and vegetable forms. The fossil vegetable remains are chiefly stems, branches, roots, and impressions of leaves of plants; the animal fossils are bones, teeth, scales, or other hard external parts, such as shells and polyparia. After the discovery of a better distinction between the different formations belonging to the aqueous rocks (of which distinction the first attempts are due to Werner, the man who made straight the way of the geologists of our century), the persuasion became more and more fixed that in general the oldest and deepest strata contain fossils of plants and animals the most different from the now living species, and that by degrees the organic forms were modified in such a manner that the last-formed strata contain many remains of such species as do not differ substantially from those of the present time.

In a short essay on this subject it is impossible to prove this statement in detail, but the assertion is the result of all the investigations of the palæontologists of this century—Cuvier, Brongniart, Agassiz, and Owen. And the natural corollary of

* Lamarck, i. p. 256.

this theorem is that the present species of plants and animals are of a more recent date, that they are not of the same antiquity as plants and animals in general in the history of our planet. If we suppose that the now living species of organic beings lived already at the same periods to which the remains of older formations belong, then it is perfectly inexplicable why we do not find the remains of them, or at least of many of them, in all the different strata. If an antiquary finds in some old burial-places only weapons and instruments made of stone or bone, in other sepulchres only bronze implements, he is led naturally to the conclusion that these remains belong to different periods of civilization; but he would be inconsiderate and devoid of all justification if he admitted that the people in whose sepulchres he had found only stone implements were likewise in the possession of bronze weapons, which he did not find. In the same manner palæontological questions are to be discussed. When one of our contemporaries* proposed the opinion that, from the first beginning of organization upon our planet, all species of plants and animals were created at once, the now living forms as well as the others the remains of which are found in the strata of mountains, and that these various strata were formed after the creation of all these species of organic bodies, many of which died out, some in a remote, others in a more recent period,—when, I say, one of our contemporaries proposed this opinion, no antagonist arose, and the paradox passed away hardly remarked. Evidence to the contrary was too strong, and in such a case silence is preferable to the refutation of palpable error. Like silence is also better than demonstration of what is evident of itself.

It would require nearly a perfect abnegation of all knowledge gathered by observation if we did not admit these two fundamental results of palæontological investigations,—first, that there existed formerly on our planet other species of plants and animals than those which are now living; and in the second place, that the now living species of plants and animals did not exist from the beginning of life on earth. As to the last thesis, we are authorized to say with confidence that our now existing species of Mammalia did not live at the same period with the *Anoplotheria* and *Palæotheria*, the bones of which are dug up in the Tertiary formation of the neighbourhood of Paris. The fishes now swimming in European seas did not swim in the waters whose muddy deposits gave origin to the copper-slate of Maesfeldt, &c. These conclusions are the results of comparative inquiries. If the species now living existed at those periods,

* Kutorga, Einige Worte gegen die Theorie der stufenweisen Entstehung der organische Wesen auf der Erde. Bonn, 1839, S. 24.

there can be no reason given why their remains, their bones &c., were never found together with the remains of the extinct species alluded to. Perhaps the first thesis seems not so clear—that those species which we find in the strata of different aqueous rocks and deposits are truly extinct. Some may be disposed to ask whether our survey of the now living organic world is so complete that we know all the species. This is certainly not the case; but the chances of discovering species similar to those we know as yet only as fossils decrease daily, and the whole objection loses its strength because geological investigations teach us that the animals and plants of older strata are specifically different from those of recent ones. Thus not only one series of organisms is extinct, but there are several such series, the one succeeding the other. Species of the different tertiary strata are different from each other. All these are different from those of the Chalk formation; those of the Chalk formation are unlike those of the Oolitic series; others, again, are to be found in the strata of the New Red Sandstone, others in the Coal formation &c., all differing.

That some species became extinct seems in general a fact that is not so strange as that some species originated in succession—that there were consecutive and distinct creations of organic forms. Of the first fact we do not want examples, even in recent periods, within the three last centuries of history. I may refer to the well-ascertained fact of the extinction of the Dodo—a bird recorded to have been seen by several travellers, and represented in various pictures and prints. Greater still is the number of instances of local exterminations, local extinctions of species. In many civilized parts of Europe several species have now totally disappeared, which formerly were not uncommon in the same localities. At the time of Xerxes lions lived in Greece, and attacked the camels of his army*. Even a century and a half after that time, lions are mentioned by Aristotle as living in Europe†. In many parts of Europe the beaver was common in the middle ages, where it is now entirely unknown. In Wales and Scotland the bear was found in the first ten centuries of the Christian era; and even the wolf was not entirely extirpated till about the end of the 17th century‡. The extinction of species in præhistorical times, in the different geological periods which elapsed before the appearance of man, differs only in being more general—we should almost say, in being total, if the investigations of Ehrenberg did not teach us that some

* Herodot. vii. 125, 126.

† Hist. Animal. viii.

‡ In 1680, when the last wolf fell by the hand of the famous Sir Ewen Cameron. (Thos. Pennant's 'British Zoology,' new ed., London, 1812, p. 88.)

microscopic species, some Infusoria and Algæ, which belong to the present creation are found likewise in very old strata, as in those of the Carboniferous or even of the Silurian group*. There are two suppositions we can make respecting the manner of the extinction of species in the history of the earth. We can ascribe that extinction to a change of external conditions, by the influence of which the life of the organisms was affected, and by whose continued action the species, formed for other conditions, diminished in number, and sooner or later perished altogether; or we can ascribe the fact to the sudden action of some violent revolutions on the globe, by which plants and animals were destroyed. The latter explanation formerly predominated; the assumption of a general cataclysm, by which the inhabited earth was destroyed, led easily and almost unavoidably to this belief. The more extended knowledge of facts showed afterwards that a deluge recorded in human history could not explain the great diversity of fossil remains which were found in the strata of mountains; and the hypothesis was modified by the assumption of several geological cataclysms, by which, during the modelling and remodelling of the earth, various generations of plants and animals perished, and were imbedded in the deposits of the water†. In our time the explanation is generally given up; but it seems that some writers go too far by an entire denial of lesser or much more sudden revolutions, which were natural consequences of the upheaving of volcanos and of chains of plutonic mountains.

That there was a succession of new species of plants and animals, a repetition of distinct creations, is, as I have already said, a conception which seems not so favourable to acceptance. There is nothing, indeed, in actual observation of the present order of nature that can be compared to this new creation. Almost daily, it is true, some formerly unknown species of plants or animals is registered in our catalogues; but there is no more reason to think that they are really new than to believe that the New World was upheaved from the ocean at a later period than Europe because its discovery was only made in the 15th century. There is, however, a power of evidence which cannot be annihilated by our doubts or by the difficulty of understanding the facts; and, in our researches on natural objects and phenomena, it is not fair to ask what we can explain before we see what we are obliged to admit by the authority of obser-

* Microgeologie. Das Erden- und Felsen-schaffende Wirken, &c. Leipzig, 1854, fol. S. xiv.

† Cuvier, for instance, speaks often of such "catastrophes et révolutions subites," in his famous and always remarkable 'Discours sur les Révolutions de la Surface du Globe.'

vation. The succession of new species of plants and animals on the surface of the earth seems to be a fact that can hardly be denied, although we cannot explain it. If we ascribe no unlimited duration to our planet, if we do not believe that it existed from eternity, we are compelled also to admit a beginning of organic bodies—an origin of life on its surface. However impossible it may be to explain the origin of organic bodies, the creation of herbs and trees, and of moving, creeping, flying, and swimming things, this difficulty of explanation affords no reason to deny that there was a beginning. Geological investigations on strata of rocks and fossil remains of a former animal and vegetable world afford proofs that our planet is older than sixty centuries; but they cannot give a demonstration that it had no beginning at all*.

To avoid the difficulty of several consecutive creations, some writers have believed that the now living organic bodies originated by changes from those species of plants and animals which we consider to be extinct. No one, however, so far as I know, has given a detailed and accurate account of the manner by which the different species which are commonly considered as extinct changed into the now living species. Even if their hypothesis were admitted, we cannot deny that many forms living in former periods have totally disappeared. In the actual condition of the animal kingdom on the surface of our globe there are only two or three species of *Nautilus*. It is impossible to think that to the production of these the large number of more than a hundred species of that genus was required—species which succeeded each other in the various periods of the history of the earth, from the Silurian to the Tertiary strata. Moreover we have the much greater number still of other multilocular shells of Cephalopods, the Ammonites, which are found in different strata, but are wanting in the Tertiary strata as well as in the existing order of nature.

If we once admit such a mutability of species, we wander into the immense field of speculation, where reasoning, or rather imagination, must fill up the gaps left by actual observation. There is a difficulty in this hypothesis which seems to have been commonly overlooked. If we consider the now living species as produced by changes from the species of former periods, much

* It is quite unnecessary to say that, in our day, a literal belief in the Bible cannot interfere with the results of astronomical or geological investigations. But whatever is stated on the chronology of the acts of creation, the investigation must, of course, end in the admission of some first origin, concerning which science cannot say anything, save the sublime and simple words of the first verse of the first book of the Bible—"In the beginning God created the heavens and the earth."

indeed among these recent forms cannot be explained without the aid of various suppositions; and, on the other hand, there is a great number of superfluous species in the existence of so many fossil forms. An unprejudiced inquiry shows evidently that some tribes or families of plants and animals were predominant in one, others in another period, and that a small number of groups, on the contrary, have been in existence in all the different periods, that they always have had their representatives in some species, and are not wanting in the recent order of nature.

There still remains, before we conclude our remarks on the history of organic bodies on the surface of our earth, one question which deserves discussion. Is it possible to deduce any general conclusions concerning the successive development of the organic world from the investigation of fossil remains, and by comparing them with each other? This question ought not to be misapprehended. We can reject indeed the hypothesis of De Maillet, who admitted that a bird was the offspring of a flying-fish, and yet believe that geology supplies us with proofs of a successive development, of an advance in the complication of organic beings. Cuvier*, for instance, admitted such a succession, although he was far from admitting such genealogies. He stated that reptiles are found considerably earlier, or in more ancient strata, than mammals, and that the more recent formations contain species which appoach nearest to those now living. Remains of Mollusca and fishes are found in the most ancient strata; reptiles form the predominant Vertebrata in the Jura and Chalk formations; and remains of mammiferous land-quadrupeds are, according to his view, only to be found in Tertiary strata. Similar remarks have been made by those writers who have devoted themselves to the investigation of fossil plants—Adolphe Brongniart, Göppert, and others: they admit that the earliest vegetation was very simple, and that there was a slow advance and manifest progress in succeeding periods towards the now living vegetable kingdom. Brongniart admits four great periods of ancient vegetation, the first ending with the Carboniferous formation†. This elder flora of our planet was chiefly formed by ferns and tree ferns. Those plants, which now constitute only one-fortieth of all the known living species, prevailed then in such a remarkable manner that they formed two-thirds of all the species which made up the flora of

* Discours sur les Révolutions, &c. See 'Recherches sur les Ossemens Fossiles,' 3e éd. 4to, Paris, 1825, i. pp. 54, 146–172.

† Histoire des Végétaux fossiles. Paris, 1828–1837, 4to. Compare also an abstract of his researches in 'Ann. des Sc. Nat.' tome xv. 1828, pp. 225–258.

the Carboniferous period. The remaining species of this flora are referred to the Lycopodiaceæ and Equisetaceæ*. The second period includes all the strata above the Coal-formation to the Upper Red Sandstone. In comparison to the first, the number of vegetable remains is only small; but, besides Acrogens, we observe amongst them Coniferous trees and Monocotyledons. In the third period, which comprehends the Oolitic and Cretaceous group, Cycadeaceæ are predominant, and next to them follow ferns, the rest consisting chiefly of Monocotyledons. The fourth period embraces the Tertiary strata. It is only in this that remains of Dicotyledons are numerous.

These results have been in part modified by new discoveries; but even now it is certain that there is a great diversity between the species and genera, and even the greater divisions of a former and later vegetable and animal world. As to these modifications in the results of palæontological inquiry, it is now proved that the opinion of Cuvier, by whom the first apparition of land-mammals was stated to have been posterior to the Chalk period, must be given up. Already, during the lifetime of Cuvier, some few remains (lower jaws) of mammals were found in the slate of Stonesfield, which was proved to belong to the lower Oolitic strata, and consequently to be of a much more ancient date than the Chalk formation, on which the Tertiary strata are resting. In the last decennium, several new examples of mammalian bones found in oolitic strata have been brought to light†; and low in the Upper Lias two molar teeth have been found, in 1847, which Plieninger refers to a mammalian genus called by him *Microlestes*.

But it seems that it would be overrating the value of these facts if we inferred from them that all great classes of the animal kingdom existed from the first beginning of life on the surface of the globe, that all were represented by different species, from the first geological periods till the modern era. In comparing the floræ and faunæ of different countries—a comparison which forms the fundamental part of a geography of plants and animals—we must look chiefly to the dominating groups, to the families and genera which are distinguished by the larger number of species. In the same manner, the characteristic features of different geological periods in relation to organic beings

* To these must be added some Coniferous trees, more allied to Araucariæ than to any of our European firs.

† In the freshwater strata of Purbeck there were discovered, in 1856 and the following years, a number of lower jaws, and even a fragment of a skull, of mammals, forming different genera, and partly allied to the insectivorous marsupial genus *Amphitherium* of Stonesfield. (See Sir Charles Lyell, Supplement to the fifth edition of a Manual of Elementary Geology, Lond. 1857, 8vo, pp. 15–27.)

must be borrowed from a numerical evaluation of natural divisions, families and groups.

In these conclusions, however, great care and circumspection will always be required, because we shall never be able, by our investigation of fossil remains, to acquire a competent knowledge of a flora or a fauna of a former period. Ten years ago, a recension of all fossil species of extinct animals and plants of the different strata was given by Prof. Bronn, of Heidelberg. He then enumerated 708 species of mammals, 148 of birds, 384 of reptiles, and 1461 of fishes as fossil. In this recension all the different strata are combined and mixed together. When we compare this general result with an evaluation of the now living species of these four classes of Vertebrata, we remark a very great difference in the relation of the numbers. The class of birds, for instance, in the present period embraces a much greater number (perhaps 5 or 6 : 1) than that of mammals. In the combined faunæ of former periods the relation between the species of birds and mammals would be, on the contrary, like 1 : 5. But still greater would be the difference in the comparative numbers of species in the lower classes. Prof. Bronn assumes 2885 species of fossil Articulata, 13,805 of Mollusca, and 4895 of Zoophytes (chiefly Echinoderms and Polypes). In the present condition of the organic world, the number of known species of articulated animals is much greater than that of the Mollusca—nay, even than that of all the other classes put together. The class of Insects (now so greatly predominant that several orders contain myriads of species) is represented in Bronn's list by only 1551 species*. Even when we grant that the relation between the numeric value of species belonging to each class was different at former periods (and this cannot be denied), we must still have recourse to other reasons for the explanation of these facts. We must search for another solution of the question why birds amongst the Vertebrata, insects amongst the lower animals, have left such a small number of remains in comparison with those of fishes and mollusks. Moreover, of the fossil remains of insects, nearly all belong to Tertiary periods; Tertiary species of insects form fourteen-fifteenths of the whole number. It would be an inconsiderate and highly uncritical conclusion, if we were led by this evaluation to the belief that the number of insects was so small in former periods, because we see so few remains of them in the strata of our rocks. It is also clear that the vestiges of Medusæ and other soft animals, which are so numerous in our seas, may be totally wanting,

* Leonhard und Bronn, 'Neues Jahrbuch für Mineralogie,' 1849, S. 128; H. Bronn, 'Handbuch der Geschichte der Natur,' IIIter Band. Stuttgart, 1849.

without giving a right to deduce from that negative evidence any conclusion as to the absence of those animals.

From the foregoing remarks it follows that our knowledge of the former species of organic beings is imperfect, and that it will ever be so, even when it is enlarged and newly remodelled by the most splendid future discoveries. General comparisons must thus be restrained to some classes and groups. Such are, in the animal kingdom, the reptiles, fishes, and the mollusks (chiefly the Cephalopods, the Conchifera, and the Brachiopods), the Echinodermata, and the Corals. A comparison in such a limited direction will certainly give some interesting results. A fundamental point for these investigations has already been gained in the conclusion, deduced from a great number of facts, that the different formations are characterized by their respective fossils*, which, indeed, is but another formula for the statement that the various species have a distinct term of duration, and that their existence ended sooner or later. It will also be seen that the oldest strata contain remains chiefly of non-vertebrate animals, that only in later strata a greater number of Vertebrata appear, and that in the strata which embrace the Lower New Red Sandstone, up to the Chalk, reptiles (chiefly *Sauria*) are predominant. It is first in Tertiary strata that the remains of Mammalia become numerous, of which class, as we have already said, remains are indeed not entirely absent in older strata, but are in that case in a subordinate proportion to the remains of reptiles †.

* The late Prof. Jameson remarks that Werner, his master, already made the observation that "different formations can be discriminated by the petrifactions they contain, that petrifactions appear first in transition rocks, that these are but few in number and of animals of the zoophytic or testaceous classes. In the older floetz rocks they are of more perfect species, as of fish or amphibious animals; and in the newest floetz and alluvial rocks, of birds and quadrupeds, or animals of the most perfect kind." See his notes following his translation of the 'Discours' of Cuvier, 'Essay on the Theory of the Earth,' 3rd ed. Edinb. 1817, pp. 232, 233. But already, long before Werner, as is stated by Humboldt (Essai géognostique sur le Gisement des Roches, Paris et Strasbourg, 1826, 8vo, p. 37), the first point—that different formations can be distinguished by their fossils—was acknowledged by Lister in reference to fossil shells. It is this peculiarity which gave occasion to the so-named *Coquilles caractéristiques* of French authors, or *Zeitmuscheln*, as they are named by the German geologists, which were duly appreciated by the great Leopold von Buch in several of his latest papers.

† These general remarks on the succession of animal life at the surface of our globe were proposed, in 1841, by the eminent palæontologist, L. Agassiz, in his address at the inauguration of the University of Neufchatel, 'De la Succession et du Développement des Êtres organisés à la surface du Globe terrestre dans les différents âges de la Nature' (Neuchatel, 1841, 8vo). In this work we have the periods, (1) of Fishes, (2) of Reptiles, and (3) of Birds.

But how probable soever such a successive change and advance in perfection may be, the geological facts cannot be adduced, without alteration and interpolation, as confirming the doctrine of a continuous change of beings, such as would be required to establish a development by which more complicated forms are the offspring of more simple prototypes. Such a view would require another distribution of fossils in the succeeding strata—so that, for instance, fossil Cephalopods should be the latest of all mollusks, and not, as they really are, already represented in the oldest fossiliferous rocks. If the species have changed by degrees, we should expect to find traces of this gradual modification. If one form gave birth to another, why should we not find some fossils between mollusks, or insects, and Vertebrata? Such a discovery has never been made.

It is plain, if we are sincere and unbiassed observers, that geological facts give no support to those hypotheses we have been treating of, and that they rather militate against such theories, which cannot deserve the name of *natural* theories at all. Creation, the first origin of things, is, and perhaps always will be, a mystery; the mystery is by no means elucidated if we assume germs. The first animal, for instance, that possessed organs of vision has to be derived from another without eyes. But why should such a supposition seem clearer and more intelligible than the creation of an entire animal provided with eyes? Here science does not shut her books, as it has been said by some: true science never opened books on such questions.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Dec. 8, 1863.—E. W. H. Holdsworth, Esq., F.Z.S., in the Chair.

On the Breeding of the Green Sandpiper (Helodromas ochropus). By Alfred Newton, M.A., F.L.S., F.Z.S.

Ornithologists are aware of the very different positions often chosen for their nests by birds of the same species. Thus Eagles may be found sometimes building their eyries upon trees, at others on cliffs, and again sometimes absolutely upon the flat ground. The same may be said of some species of Falcons and of some Herons. Certain Crows also and the Stock-Dove (*Columba Œnas*) exhibit a like disparity of habit. Even among the members of the Gallinaceous order a similar diversity is occasionally, though rarely, to be observed. I have been told, on authority I cannot question, of a common Pheasant (*Phasianus colchicus*) and of a Capercally (*Tetrao Urogallus*) each choosing a nest in a tree wherein to lay its eggs. Instances of the common Wild Duck (*Anas Boschas*) breeding in hollow stumps

of trees are very frequent; and with the Ducks of the genus *Aix* this seems to be the normal mode of nidification. But, excepting in the last case, this peculiarity in the selection of a site for the nest seems to result from the particular fancy (or instinct, it may be) of the individual; and in that exceptional case the general habits of the birds are so essentially arboreal that we need not wonder at the fact of their using trees for their nurseries as well as for their usual places of lodging. The only instances parallel to the one I am going to adduce are, so far as I can call to mind, those of the Golden-eye (*Clangula Glaucion*), the Goosander (*Mergus Serrator*), and the Smew (*Mergus Albellus*). Each of these three birds departs from the manner of nidification which obtains among its brethren, just as I shall show that the Green Sandpiper (*Helodromas ochropus*†) does.

Though I do not pretend to lay before you any novel facts this evening, yet it will be, I think, admitted that hitherto we have had in England but little positive information on the mode of breeding of the Green Sandpiper; such as it is, however, I will proceed to notice it. First, I must say that I think the story of the nest of this bird "by the side of a clay-pit" in Norfolk, as told in Mr. Yarrell's 'British Birds' (vol. ii. p. 529) and in Mr. Lubbock's 'Fauna of Norfolk' (p. 75), can hardly be relied on—not, of course, that there is the slightest reason to doubt the implicit good faith of Sir Thomas Beevor, on whose authority it appears to rest. Next there is the statement contributed to the last edition of Mr. Hewitson's 'Eggs of British Birds' (ed. 3. vol. ii. p. 334*) by Mr. Tristram, to the effect that he found the species breeding near sluggish streams or mountain tarns between Bodö and Quickjock in Lapland. Now this particular district has since been visited by three other excellent observers, to no one of whom did the Green Sandpiper reveal itself. I therefore hope I may be pardoned for suggesting the possibility of a mistake in my friend's assertion.

In the 'Naumannia' for 1851 (vol. i. part 2, p. 50), Herr Pässler mentions that he had, through his friend the Oberförster Wiese, obtained an egg of *Totanus glareola*, with the remark that this species of Sandpiper always "nests upon a tree;" but in the same periodical for 1852 (vol. ii. part 1, p. 95) he states that Baron von Homeyer had informed him that the egg in question was not that of *T. glareola*, but of *T. ochropus*, and adds that during his stay at Haff he had seen many nesting-places of this latter species; they were on the borders of "*Elsenbrüche*" [*quære*, swamps of the Service-tree (*Pyrus domestica*)?], in the middle of the forest, where the trees stand upon hillocks. In the 'Journal für Ornithologie' for 1855 (vol. iii. p. 514), the above-mentioned Herr Wiese, writing on the Ornithology of Pomerania, especially in the district of Cöslin, says that he had first heard from an old sportsman, who knew the peculiarities of all the forest-animals, that the *Totanus ochropus*

† The osteology of the *Tringa ochropus*, Linn., presents such a marked deviation from that of the other *Totani* which I have examined, that I do not hesitate in this case to follow Dr. Kaup in considering it the type of a distinct genus.

nested in old Thrushes' nests, which information, he remarks, "I naturally did not believe;" but he states that some years after, in 1845, he obtained from the same man four fine eggs of a bird of this species, which for many years had been wont to nestle in an old beech tree. Still doubtful on the subject, the following spring he himself found a nest of the bird on a pine which had a fork about five-and-twenty or thirty feet high. "Joyfully," he says, "I climbed the tree, and found in that fork four eggs on a simple bed of old moss." He goes on to say that in the spring of 1853 he again obtained four eggs of the same species; and in the spring of 1854 (the year he was writing) he found a nest placed in the old nest of a Song-Thrush, out of which the shed buds of the beech had not so much as been removed. There were four eggs, which were hard sat upon on the 25th of May.

In the 'Naumannia' for 1856 (vol. vi. p. 34), in an account of an excursion in Western Pomerania ("*Vorpommern*"), Dr. Altum states that *Totanus ochropus* returns annually to its old nesting-places, these being Missel-Thrushes' nests, whose remains were still to be seen, often some hundred yards distant from the nearest pool, and their height fifteen feet or more from the ground. The same journal for 1857 contains a valuable series of observations on the birds of the same district by Herr W. Hintz, in which the author says (vol. vii. part 1, p. 14) that on the 6th of May, 1855, he found three eggs of this bird on an "*Else*" [quære, *Pyrus domestica*?] in an old Dove's nest, as he thinks, though he states it might have been that of a Jay. Formerly, he proceeds to remark, he had only observed this Sandpiper to use old nests of *Turdus musicus*, excepting once, when he found some young ones, only a few days old, hard by a river-bank on a layer of pine-needles on an "*Else*"-stub.

Soon after the publication of this last piece of intelligence, appeared that part of Herr Bädeker's 'Eier der Europäischen Vögel,' wherein (fol. xxx. no. 5) *Helodromas ochropus* was treated of, and a concise summary of the foregoing accounts was given. This was remarked upon by the writer of an article in 'The Ibis' for 1859 (vol. i. p. 405), and thus the curious facts which I have above detailed were made generally known, for the first time I believe, to English readers. In 1860 a short recapitulation of them was also published by my friend Dr. Baldamus, in the continuation of Naumann's celebrated 'Vögel Deutschlands' (vol. xiii. p. 241). Towards the close of the same year also that excellent observer who veils his name under the signature of "An Old Bushman" contributed a series of articles to 'The Field' newspaper, in which he described his own experience of the Green Sandpiper's way of nesting in Sweden. The natural-history editor of that paper, not knowing what had been already written, exhibited some signs of scepticism on the subject, whereupon his correspondent reiterated his statement, saying (Field, No. 411, Nov. 10, 1860, p. 393) that "there is no doubt about the matter," and adding that he "never took the nest on the ground."

I have now only to read to you a portion of a letter, dated Novem-

ber 27, 1861, which I received from my friend Pastor Theobald, of Copenhagen. He says as follows :—

"The nidification of *Totanus ochropus* is so remarkable that I do not fear to trouble you with the history the Forester Hintz [whom I have mentioned above] has given me. He writes :—'This year I succeeded in finding the nest of *Totanus ochropus.* On the 9th of May I took four eggs of this bird ; they were found in an old nest of *Turdus musicus,* and seemed to have been incubated about three days. The very same day there were brought to me four other eggs of this bird, also found in a Thrush's nest. * * * The 10th of May there was shown to me a nest, thirty feet high, on an old birch, the bird having chosen an old decayed nest of a Squirrel. This nest was the highest I have ever seen. Three young ones had just been hatched ; in the fourth egg the bird was about to break the shell. One jumped down and concealed itself on the edge of a water-pool. The 11th of May a nest with four fresh eggs was found, but they did not come into my hands ; this was in an old Pigeon's nest on a *Pinus rubra,* and full of dry pine-leaves. The 20th of May two eggs, almost burst by the young, were found in an old Thrush's nest, the two missing birds having most likely already left the nest. The 22nd of May four young ones, apparently but a few hours old, were found in the old nest of a *Lanius Collurio,* in a juniper three feet high. The 24th of May four young ones were found in the hole of a *Populus tremula* thrown down by the wind. The year before, *Muscicapa luctuosa* had its nest in the trunk as it lay on the ground ; this year *Totanus ochropus* had chosen the same opening. When I approached the trunk, the young ones, perhaps four-and-twenty hours old, jumped away and hid themselves in the grass among the branches. All these nests were near the water—two on the edge of a rivulet, the others on wet morasses, the distance from the water being at most six feet.' "

I have the pleasure of exhibiting to you a small series of a score of the eggs of this bird, as well as three nests. The latter were sent me by Mr. H. W. Wheelwright, and were obtained by him this year in Sweden. They are so ragged and dilapidated that, as is often the case with ancient ruins, it is not easy to say of what race the builders were. From one of them, five-and-twenty feet up in a fir tree, the mother was killed on the 28th of May, and I produce her skin. Three of the sets of eggs belonged to these nests ; a fourth set was the contents of Forester Hintz's nest of the 9th of May 1861, mentioned in his interesting letter. This I owe to Mr. Theobald and some other friends in Copenhagen. The remaining four eggs are odd ones obtained by Mr. Wolley and myself from Dr. Kjærbölling.

Jan. 26, 1864.—E. W. H. Holdsworth, Esq., F.Z.S., in the Chair.

An extract was read of a letter from Dr. Harry Anthony to Mr. Louis Fraser, dated Brass River, Bight of Biafra, 3rd Dec. 1863, referring (as follows) to what was supposed to be a species of *Clarias* :—

"I intend to try and send you by my next ship some of the 'Black

Fish' out of the bush, called by the natives Egalegala; they are perfectly black, and are very fine eating. They are so fat they will fry without butter, taste something like eels; they are in shape something like '*Cat-fish*,' with filaments from the lower jaw; they live amongst the mud in the mangrove bush. It would be grand to acclimatize them; they are such fine eating. They would drive eels out of the market."

Description of Aspidiotes melanocephalus, a New Snake from Port Denison, N.E. Australia. By Gerard Krefft, Acting Curator and Secretary, Australian Museum, Sydney.

Fam. Boidæ.

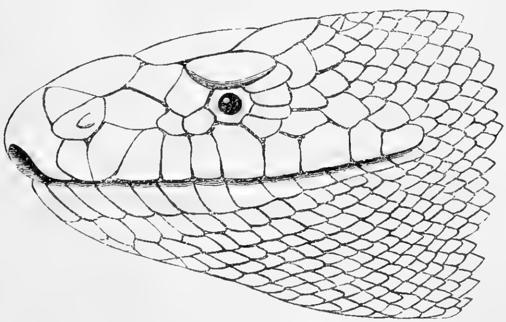
Aspidiotes, nov. gen.

Crown covered with broad shields reaching behind the eyes; the remaining part of the head scaly; labial shields without pits, the front ones high and narrow, the hinder shields lower and broad. Nostrils lateral, in the middle of a plate, two loreals, two anterior and four posterior oculars; superciliaries broad, rather prominent above the eye; nasal shield very large, much produced backwards, and deeply grooved on its lower edge. Scales smooth, in fifty-two series on the middle of the body; ventral plates rather narrow; subcaudals entire, except the last ten or twelve, which are divided. Tail conical, prehensile, ending in a blunt point. Head rather high, of moderate size; teeth not very large (smaller than in *Morelia*). Body thick and compressed.

Aspidiotes melanocephalus.

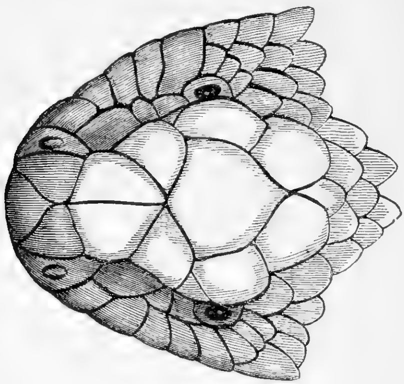
Scales in 52 series on the middle of the body. Ventral shields narrow, 330. Anal entire. Subcaudals $51\frac{13}{13}$.

Head rather high; body thick and compressed; tail conical, tapering, prehensile, ending in a blunt point; anal spurs small; ten upper



labials, the sixth coming into the orbit; two anterior and four posterior ocular shields; two loreals, the second nearest to the eye very small; one nasal, pierced by the nostril; eye moderate, pupil ellip-

tical, erect. Three pairs of frontal shields, the middle pair longest; vertical broad, the largest shield of the head, with an obtuse angle in front and an acute one behind, sides rounded; superciliaries



large, prominent above the eyes; occipitals distinct, but smaller than the vertical, forked and rounded behind; the first pair of frontals small, triangular; the second pair five-sided, nearly as large again as the first pair; the third smaller than the second and larger than the first, quadrangular. Of the fourteen lower labial shields, the first seven are narrow and elongate, the rest broad; no groove upon the labials. The nasal shield is very broad, with a deep pit, shaped like a bean, and much produced backwards. Head moderate; body thick, compressed; anal spurs small. Colour light brown, with a series of darker rings, which become indistinct near the sides; below yellowish-white here and there, with a few dark blotches; head and neck jet-black above and below. Total length 7′ 10″.

Hab. Port Denison.

Description of a New Species of Mormyrus. By Dr. A. Günther.

Only a short time ago I described* a peculiar species of *Mormyrus*, *M. Petersii*, distinguished by a very long mandibular flap. I have the pleasure to lay to-day before the Society another species with the same structure of the fins, and with a similar prolongation of the lower jaw. It comes, like *M. Petersii*, from West Africa. The peculiar form of the snout has suggested the specific name of

Mormyrus Tamandua.

D. 28. A. 31. V. 6. L. lat. 80. Body compressed, rather elongate—its greatest height, between the origin of the dorsal and anal fins, being two-ninths of the total length (without caudal); the length of the head is one-fourth of the same. The snout is much

* Wiegm. Arch. 1862, p. 64.

prolonged, tubiform, slightly tapering, and curved downwards, the distance between the eye and the end of the mandibular flap being twice that between the eye and the gill-opening. The mouth is very small, at the extremity of the snout, with the jaws equal, and armed with two pairs of feeble conical teeth above and below. The mandibulary flap is as long as the eye. The eye is covered with the skin, but appears through from below it. The pectoral is nearly twice as long as the ventral, and extends beyond its base. The dorsal and anal fins are opposite each other, and placed on the caudal portion of the body, the origin of the former being in the middle between the occiput and the root of the caudal. The scales on the trunk are rather small and irregularly arranged, but become gradually larger and more regular posteriorly. Coloration uniform.

The single specimen obtained is 10 inches long.

We add, for comparison, the diagnosis of the other species mentioned above:—

MORMYRUS PETERSII.

D. 27. A. 34. L. lat. 66. The mandible is prolonged into a long, conical fleshy appendage, which is nearly half as long as the head. Dark brown, with two lighter cross bands.

Hab. Old Calabar.

ON SOME NEW SPECIES OF CENTRAL-AMERICAN FISHES. BY DR. A. GÜNTHER.

Our Corresponding Member Capt. J. M. Dow having sent to this Society a second collection of Central-American Fishes, a complete series of the species contained therein has been deposited by our Secretary in the British Museum. The following is a list of those which I have examined, a few others having been omitted, as they belong to families in the revision of which I am engaged at present or shall be in a very short time:—

I. *Species collected on the Pacific Coast of Panama.*

1. SERRANUS SELLICAUDA, Gill, sp.

2. RHYPTICUS MACULATUS, Holbr.

3. MESOPRION NOVEM-FASCIATUS, Gill, sp. Very closely allied to *M. griseus.*

4. MESOPRION, n. sp. There are two young specimens of an apparently undescribed form in the collection; but the description and determination are better deferred until more examples have been obtained.

5. PRISTIPOMA MELANOPTERUM, C. & V.

6. PRISTIPOMA DOVII, n. sp.

D. $\frac{12}{16}$. A. $\frac{3}{9}$. L. lat. 48. L. transv. 8/15. The height of the bod yis one-half of the total length (without caudal); the length of

the head one-third. Snout obtuse, not much longer than the eye; cleft of the mouth small, the maxillary extending to the vertical from the anterior margin of the orbit. Lips thick; a pair of pores on the symphysis of the lower jaw, a central groove behind it. Snout naked, the remainder of the head being scaly. The width of the interorbital space is much less than that of the orbit. Dorsal and anal spines exceedingly strong; the third of the dorsal fin is the longest, and nearly two-thirds as long as the head. The second anal spine is much longer than the third, and a little shorter (but stronger) than the third of the dorsal fin. Each ray of the soft fins is accompanied by a series of minute scales, but only on the caudal fin are these scales dense enough to cover the rays. Caudal fin slightly emarginate. Silvery, with four black cross bands: the first runs from the occiput through the eye to behind the angle of the mouth; the second from before the dorsal fin to below the base of the pectoral; the third from the base of the sixth, seventh, and eighth dorsal spines to the vent; the fourth descends from the origin of the soft dorsal to that of the soft anal. Fins blackish.

Only one specimen, $8\frac{1}{2}$ inches long, is in the collection.

7. Polynemus approximans (Lay & Bennett ?).

D. $7|\frac{1}{13}$. A. $\frac{3}{15}$. L. lat. 60.

8. Caranx, n. sp. There is a young specimen in the collection which appears to belong to an undescribed species closely allied to *C. Carangus* and *C. Hippos*.

9. Caranx leucurus, n. sp.

D. $8|\frac{1}{28}$. A. $2|\frac{1}{24-26}$. Very closely allied to *C. bicolor*. The first dorsal fin is composed of short, stoutish spines, the fourth of which is the longest, but scarcely longer than the eye. The soft dorsal and anal are rather elevated; the caudal is emarginate, and has the lobes rounded. Teeth very small, forming a single series in both jaws; palate smooth. The height of the body is one-half of the total length (without caudal), the length of the head one-third. Snout rather obtuse, the jaws being equal in front when the mouth is closed; the maxillary extends to below the anterior margin of the orbit. The lateral line makes anteriorly a subsemicircular curve, the width of which is contained from $1\frac{2}{3}$ to $1\frac{4}{5}$ times in the length of the straight portion; it becomes straight behind the vertical from the origin of the second dorsal, and is armed with about fifty small and low shields, only a few of which terminate in a depressed spine. The pectoral fin extends to the anal spines. Brownish grey, body with six dark-brown vertical bands: the first crosses the body behind the base of the pectoral, and the fourth descends from the middle of the soft dorsal fin. Operculum with a large black spot. Dorsal, anal, and ventral black; pectoral and caudal whitish.

Only two young specimens are in the collection, the larger being 3 inches long.

10. ? Caranx dorsalis, Gill, sp.

11. Gobius soporator, Cuv. & Val.

12. Eleotris seminudus, n. sp.

D. 7|11. A. 9. The head and the trunk are naked; the tail is covered with small scales; head depressed, broader than high, flat above, its length being two-sevenths of the total. Snout rather obtuse, longer than the eye, with the lower jaw somewhat prominent; the cleft of the mouth extends to below the anterior margin of the orbit. Teeth in the upper jaw in a narrow band; the lower has four somewhat larger and recurved teeth in front, the others appear to form a single series; palate toothless. None of the fin-rays are prolonged; the pectoral does not quite extend to the origin of the second dorsal; ventral much shorter than pectoral, its inner ray is the longest, the others gradually decreasing in length outwards; caudal fin rounded. Brown, with numerous well-defined white cross stripes on the head as well as on the body; vertical fins black.

Although there is only a single example, 20 lines long, in the collection, the characters of this species are so well marked that I do not hesitate to describe it.

13. Salarias atlanticus, Cuv. & Val.

14. Clinus Delalandii, Cuv. & Val.

15. Clinus macrocephalus, Gthr.

16. Cremnobates monophthalmus, Gthr.

17. Atherinichthys pachylepis, n. sp.

D. $4|\frac{1}{6-8}$. A. $\frac{1}{20-21}$. L. lat. 41. L. transv. 7. The height of the body is nearly equal to the length of the head, and contained five times and a half or five times and a third in the total length (without caudal). The snout is short, not longer than the diameter of the eye, and the cleft of the mouth does not extend backwards to below the anterior margin of the eye. The anterior dorsal is composed of short, feeble spines, and its origin is opposite to the fourth or fifth anal ray. The pectoral fin is much longer than the head. The silvery streak occupies the adjoining halves of the third and fourth series of scales.

Two specimens, 6 inches long, were in the collection.

18. Mugil brasiliensis, Agass.

19. Mugil proboscideus, Gthr.

20. Gobiesox rhodospilus, n. sp.

D. 6. A. 5. C. 8–9. P. 17. A vertical fold of the skin along the lower half of the base of the pectoral; the coracoid is scarcely below the level of the upper margin of the pectoral. The distance of the origin of the dorsal fin from the caudal is contained twice and

two-thirds in its distance from the snout; the anal commences below the third dorsal ray. A very narrow band of short conical teeth in the upper jaw—one of the lateral teeth being somewhat larger than the others, recurved, canine-like. The lower jaw with a single series of teeth, the anterior being narrow incisors, whilst the outermost on each side is distinctly a canine tooth, corresponding to that in the upper jaw. Rose-coloured, with dark-rose transverse spots, each spot having an edge of deep-red dots.

Two specimens, 18 inches long, are in the collection.

21. Platyglossus dispilus, n. sp.

D. $\frac{9}{11}$. A. $\frac{2}{12}$. L. lat. 28. L. transv. 2/9. The height of the body equals the length of the head, and is contained four times and one-fourth in the total. Caudal fin rounded, with the lobes very slightly produced. Greenish olive, with a roundish black spot edged with silvery, on the lateral line, below the fifth and sixth dorsal spines; the side of the head with five or six pearl-coloured streaks, some of which are continued on the body, forming a series of round spots. An oblong variegated blotch behind the pectoral fin: it is composed of three pearl-coloured stripes, enclosing two yellow bands, each of which has an undulated purple edge. No spot in the axil of the pectoral. A short oblique yellowish streak behind the base of each soft dorsal ray; these streaks form a continuous band on the spinous portion. Anal fin with two or three whitish lines; caudal with several irregular reddish longitudinal bands, which are convergent behind.

Young specimens are much more plain-coloured; the black spot on the lateral line, however, is very distinct, and there is another at the root of the caudal.

Capt. Dow's collection contains a single young specimen; but Mr. Salvin has brought a second, apparently adult, it being $5\frac{1}{2}$ inches long.

22. Pseudojulis notospilus, n. sp.

D. $\frac{9}{11}$. A. $\frac{3}{12}$. L. lat. 25. L. transv. $\frac{2\frac{1}{2}}{8}$. The height of the body is rather less than the length of the head, and contained four times and a quarter in the total. Dorsal spines pungent; caudal fin slightly rounded. Brownish or yellowish olive; young specimens with a silvery band along each side of the trunk, above the pectoral fin. Back with four or five indistinct broad brown cross bars; a series of blotches on the dorsal fin corresponds to these cross bands, one of them, on the three first soft dorsal rays, being the largest and most distinct; it is of a deep black colour, and of an ovate form. The corners of the caudal fin are white; ventral whitish, with a broad blackish outer margin.

One adult specimen, 4 inches long, and several young ones are in the collection.

23. Julis Lucasana, Gill.

24. Dinematichthys marginatus, Ayres.

25. Microdesmus dipus, n. g. et sp. Of this we have received only a single small example; and as it is not in a perfect state of preservation, we cannot decide whether it should be referred to the Blennoids or Gadoids, or whether it is the type of a distinct family. However, we may hope that Capt. Dow will succeed in obtaining more specimens.

Microdesmus.

Body much elongate, eel-like, covered with rudimentary scales; head rather short, with obtuse snout, narrow cleft of the mouth, and prominent lower jaw. Eyes minute. Teeth in both jaws minute; palate toothless. The gill-opening is reduced to a small slit in front of the pectoral fin. Vertical fins united by a membrane, but the caudal can be easily distinguished from the two other fins. Dorsal fin very long, composed of flexible, undivided rays, like the anal. Pectorals short; ventrals thoracic, each reduced to a single ray. Vent in the middle of the total length.

Microdesmus dipus.

D. 55. A. 34. C. 16. P. 12. V. 1. The depth of the body is about one-eighteenth of the total length; the length of the head one-eleventh. The head is rather compressed, the snout short, the mouth very narrow, and the lower jaw very prominent. The minute eye is lateral and in the anterior third of the length of the head. The dorsal fin commences at a distance from the occiput which is somewhat less than the length of the head; it is nearly even, and the rays are very distinct, the interradial membrane being thin and transparent. The anal fin commences immediately behind the vent. The caudal rays are much more slender and more closely set than those of the dorsal and anal; the caudal fin is rounded, two-thirds of the length of the head. Pectorals as long as the ventrals, and half as long as the head; the latter fins are close together, and inserted a little behind the root of the pectoral. Upper parts uniform brownish olive.

The single specimen is $4\frac{1}{2}$ inches long.

26. Anableps Dovii, Gill.

II. *Species collected at Colon.*

1. Pristipoma melanopterum, Cuv. & Val.

2. Pomacanthus Paru, Gthr.

3. Sphyræna Picuda, Bl. Schn.

III. *Species from the Lake of Managua, Nicaragua.*

1. Heros labiatus, n. sp.

D. $\frac{17}{11}$. A. $\frac{8}{8}$. L. lat. 32. L. transv. 6/13. The anterior portions of the upper and lower lips are much enlarged, each forming a

moveable subtriangular flap. The height of the body is somewhat more than the length of the head, and two-fifths of the total. The mouth is very protractile; the eye occupies the middle of the length of the head. Scales on the cheek in four series. Base of the dorsal almost scaleless. Uniform red, or sometimes red irregularly marbled with black.

The largest specimen is 7 inches long.

MISCELLANEOUS.

Species of Mollusca obtained in Corunna Bay, by R. M'Andrew, F.R.S., F.L.S., *and* H. Woodward, F.G.S., F.Z.S., *in May* 1863.

CEPHALOPODA.

Loligo media, *Linn.* In market.

Sepia officinalis, *Linn.* Ditto.

GASTEROPODA.

Murex erinaceus, *Linn.* Frequent.
—— corallinus, *Scacchi.* Ditto.
—— Edwardsii, *Menke.* Rare.
Triton nodiferus, *Lam.* On shore, dead.
—— cutaceus, *Lam.* Ditto.
Nassa reticulata, *Linn.* Frequent.
—— incrassata, *Müll.* Ditto.
—— pygmæa, *Lam.* Ditto.
Ringicula auriculata, *Menke.* Do.
Purpura lapillus, *Linn.* Ditto.
—— hæmastoma. On the shore, dead.
Cassis saburon?, *Lam.* 2 living; agrees exactly with Reeve's description and figure; but locality given for latter, *Japan.*
Mangelia Philberti, *Michaud.* On shore, dead; not frequent (purpurea, var.?)
—— attenuata, *Mont.* Rare.
—— costata, *Pennant.* Ditto.
—— nebula, *Mont.* Ditto.
—— elegans, *Scacchi.* 1 specimen, dead.
—— septangularis, *Mont.* Shore, dead.
—— Lefroyii, *Michaud.* Rare.
—— lævigata, *Phil.* Ditto.
—— brachystoma, *Phil.* Ditto.
—— linearis, *Mont.* Ditto.
Mitra, sp., large size. Various worn and imperfect specimens on the shore.
Cypræa Europeæ, *Mont.* On the shore, abundant; some specimens of remarkably small size.
—— candidula, *Gaskoin.* Frequent on shore in one particular locality. The species inhabits the Madeira and Canary Islands, but has not hitherto been obtained in any other European locality.
Erato lævis, *Donovan.* Frequent on the shore.
Natica monilifera, *Lam.* Rare.
—— nitida, *Don.* Frequent.
—— n. sp. One specimen living.
Chemnitzia elegantissima. On the shore; rare.
Eulima polita, *Linn.* Ditto.
Cerithium reticulatum, *Da Costa.* Frequent.
Turritella communis, *Risso.* Not common.
Scalaria communis, *Lam.* Not frequent.
—— Turtoni, *Turton.* Ditto.
—— crenata, *Linn.* Ditto.
Littorina rudis, *Don.* Frequent.
—— saxatilis, *Johnston.* Ditto.
—— littorea, *Linn.* Ditto.
—— littoralis, *Linn.* Rare.

Solarium luteum. Rare.
—— stramineum. Very rare.
Lacuna puteolus, *Turton.*
Rissoa crenulata, *Michaud.*
—— lactea, *Michaud.*
—— parva, *Da Costa.*
—— costulata?, *Alder.*
—— striata, *Mont.* Rare.
—— cingillus, *Mont.* Ditto.
—— violacea, *Desm.*
—— labiosa, *Mont.*
Phasianella pullus, *Linn.* Frequent.
Trochus magnus, *Linn.*
—— cinerarius, *Linn.*
—— striatus?, *Linn.*
—— exiguus, *Pulteney.*
—— lineatus, *Da Costa.*
—— umbilicatus, *Mont.*
—— zizyphinus, *Linn.*
—— tumidus, *Mont.*
Haliotis tuberculata, *Linn.*
Fissurella reticulata, *Don.*
Pileopsis Hungarica, *Linn.* Rare.
Calyptræa Sinensis, *Lam.*
Patella vulgata, *Linn.*
—— athletica, *Bean.*
—— pellucida, *Linn.*
Acmæa virginea, *Müller.*
Dentalium entale, *Linn.*
—— dentale, *Linn.*
Chiton fulvus, *Wood.* Less frequent than in Vigo.
—— cinereus, *Linn.*
—— fascicularis, *Linn.*
Auricula Firminii, *Payr.* 1 spec^{n}.
Tornatella fasciata, *Lam.*
Cylichna cylindracea, *Penn.*
Scaphander lignarius, *Linn.*
Philine aperta, *Linn.*

LAMELLIBRANCHIATA.

Ostrea edulis, *Linn.*
Anomia ephippium, *Linn.*
Pecten maximus, *Linn.*
—— varius, *Linn.*
—— pusio, *Pennant.*
—— opercularis, *Linn.*
Mytilus edulis, *Linn.*
—— Galloprovincialis, *Linn.*
Crenella costulata, *Risso.*
—— marmorata, *Forbes.*
Modiola radiata, *Hanley.*
—— barbata, *Linn.*
Arca lactea, *Linn.*
—— tetragona, *Poli* (valves).
Pectunculus Glycimeris, *Linn.* Large.
Nucula nucleus, *Linn.*
—— nitida, *Sow.*
—— radiata, *Hanley.*
Solemya mediterranea, *Lam.* (a fragment). Not previously recorded as found on the Atlantic coasts north of Gibraltar.
Cardium edule, *Linn.*
—— echinatum, *Linn.*
—— pygmæun, *Don.*
—— ciliare, *Pennant.*
Cardium rusticum, *Linn.*
—— Norvegicum, *Spengler.*
—— aculeatum, *Linn.*
—— papillosum, var.?, *Poli.*
Lucina borealis, *Linn.*
—— pecten, *Lam.*
—— leucoma, *Turton.*
—— digitalis, *Linn.*
—— flexuosa, *Mont.*
—— divaricata, *Linn.* Frequent, in mud.
Circe minima, *Mont.*
Venus striatula, *Donovan.*
—— verrucosa, *Linn.*
—— fasciata, *Da Costa.*
—— ovata, *Pennant.*
—— Casina, *Linn.*
Cytherea Chione, *Linn.*
Artemis exoleta, *Linn.*
—— lincta, *Pulteney.*
Lucinopsis undata, *Pennant.*
Tapes decussata, *Linn.*
—— virginea, *Gmel.*
—— pullastra, *Wood.*
Venerupis Irus, *Linn.*
Mactra stultorum, *Linn.*
—— elliptica, *Brown.*

Mactra subtruncata, *Da Costa.*
—— solida, *Linn.*
Lutraria elliptica, *Lam.*
—— oblonga, *Chem.*
Tellina donacina, *Linn.*
—— incarnata, *Linn.*
—— tenuis, *Da Costa.*
—— crassa, *Pennant.*
—— fabula, *Gronovius.*
—— pygmæa, *Phil.*
Psammobia tellinella, *Lam.*
—— Ferroensis, *Chem.*
Donax anatinus, *Lam.*
Syndosmya alba, *Wood.*
—— prismatica, *Mont.*
Ceratisolen Legumen, *Linn.*
Solen Siliqua, *Linn.*
—— Ensis, *Linn.*
—— marginatus, *Pulteney.*
—— pellucidus, *Pennant.*
Corbula nucleus, *Lam.*
Saxicava arctica, *Linn.*
Thracia phaseolina, *Lam.*
Pandora obtusa, *Leach.*

Number of Species:—	Cephalopoda......	2
	Gasteropoda......	78
	Lamellibranchiata .	72
	Total	152

The part explored was very limited in extent and range of depth, nowhere exceeding 15 to 16 fathoms, which accounts for so many fewer species being obtained than in Vigo Bay. Had our researches extended to the inlet forming the harbour of Ferrol, it is probable that we should have been much more successful.

Of the species enumerated, only fifteen species of Gasteropoda and four of Lamellibranchiata are not known inhabitants of the British seas, including the Channel Islands.

The genera *Ringicula, Mitra, Solarium, Solemya,* and the species *Cypræa candidula, Scalaria crenata, Dentalium dentale, Auricula Firminii, Chiton fulvus, Cardium ciliare,* and *Lucina digitalis* are supposed to reach the northern limit of their range in the neighbourhood of Corunna, and are not found further east in Asturias.

The genus *Cassis* and species *Murex Edwardsii, Purpura hæmastoma, Mangelia elegans,* and *Lucina pecten* have been obtained on the coast of Asturias, and find their respective limits northward on the Spanish or French shores of the Bay of Biscay.

Lacuna puteolus is the only northern form which reaches its southern limit of range in the neighbourhood of Corunna.

Of the most characteristic forms in Vigo Bay—viz. *Chiton fulvus, Ringicula auriculata, Turritella triplicata, Nassa trifasciata, Fusus contrarius,* and *Mactra rugosa*—only the first two were obtained at Corunna.

On Arachnactis brachiolata, *a Natatory Actinia, discovered near Nahant, Massachusetts.* By Alexander Agassiz.

The Zoophyte described by Mr. A. Agassiz is a near relative of the *Arachnactis* described by Sars in his 'Fauna Littoralis Norvegiæ.' Mr. Agassiz insists particularly upon the bilateral structure of this type, which is nearly as striking as that of *Philomedusa* and *Halcampa.* The mouth is excentric, and elongated into a fissure. The

tentacles are arranged in two rows, one immediately surrounding the mouth, the other on the margin of the oral disk. Contrary to the rule in other Zoantharian Polypes, the tentacles of the first cycle are not all developed simultaneously: the oldest are placed at one of the extremities of the longitudinal axis of the mouth, and the new tentacles belonging to the same cycle make their appearance successively at the opposite extremity. Besides these tentacles, which are all pairs, there exists a single tentacle corresponding with the extremity of the mouth which approaches nearest to the margin of the disk.

The author thinks that the *Dianthea* of Busch (which, according to Leuckart, is a young *Cerianthus*) presents the same arrangement of the tentacles as *Arachnactis*. He considers that it would be desirable to form for these Actiniæ with a double series of tentacles a special suborder, characterized by the circumstance that the septa of the same cycle differ in length. This suborder would now include two families, of which *Cerianthus* and *Arachnactis* are the representatives.—*Journ. Boston Soc. Nat. Hist.* 1863, p. 525.

The Great Auk.

To the Editors of the Annals of Natural History.

GENTLEMEN,—It affords me much pleasure to send you a list of the present possessors of the birds, skeletons, and eggs of the Gare Fowl (Great Auk, *Alca impennis*). Should your correspondents recognize any error or omission, they will, no doubt, communicate with you in your subsequent Numbers.

The recent lecture delivered by Professor Owen at the Zoological Society has, no doubt, caused further inquiries to be instituted as to whether this rare bird is still extant.

I remain, Gentlemen,

Yours truly,

ROBERT CHAMPLEY.

IN ENGLAND. *Birds.*	
British Museum	2
York Museum	1
Durham Museum	1
Newcastle Museum (immat.)	1
Cambridge Museum	1
Dublin Museum	1
Lord Hill	1
Sir W. Milner	1
Mr. A. Strickland (ex. of)	1
Dr. Troughton	1
Mr. J. Hancock	1
Mr. R. Champley	1
	13

ON THE CONTINENT. *Birds.*	
Dresden Museum	1
Frankfort Museum	1
Mayence Museum	1
Florence Museum	1
Turin Museum	1
Amsterdam Museum	1
Copenhagen Museum	2
Flensburg	1
Berlin Museum	1
St. Petersburg Museum	1
M. Hardy	1
M. Turrati	1
Paris	1
	14

In England.

Skeletons.

Royal College of Surgeons (in part).
Mr. A. Newton (in part).
Mr. J. Hancock (in part).

Eggs.

British Museum	2
Liverpool Museum	1
Royal College of Surgeons	7
Lord Garvah	3
Sir W. Milner	1
Sir W. Trevelyan	1
Mr. Bond	1
Mr. Champley	9
Mr. Hancock	1
Mr. Labray	1
Mr. A. Newton	3
Mr. Scales	1
Mr. Selwyn	1
Mr. Walter	1
Rev. H. B. Tristram	1
Mr. Tuke	1
Dr. Troughton	1
Mr. Wilmot	1
	37

On the Continent.

Skeletons.

Breslau (in part).
Florence (in part).
Copenhagen (preserved in spirits).

Eggs.

America	2
Dresden	1
Leipsic	1
Dieppe	1
Paris	1
Leyden	1
Amsterdam	1
Bruges	2
Westphalia	1
Angers	2
Witten	1
Berlin	1
Copenhagen	1
	16

Total :—

Birds	27
Skeletons	6
Eggs	53

Scarborough, Aug. 11, 1864.

Some Observations on the Genus Amoria, *with Descriptions of some new Varieties.* By Dr. J. E. Gray, F.R.S., &c.

This genus, which consists of the polished Volutes, contains five species, all from Australia. They may be divided thus :—1. The spire nodulose; apex small, subpapillary (*A. lineata*, Leach, Miscell. t.). 2. The spire smooth; apex small, subpapillary (*A. Zebra*, Lamk.). 3. Spire smooth; apex large, subpapillary (*A. undulata*, Lamk.). 4. Spire smooth, conical, with an acute tip (*A. reticulata*, Reeve, and *A. Turneri*, Gray). All except the last are very permanent in their markings; the latter species is very variable in that respect, and offers several very well-marked varieties. They all agree in having a more or less dark or dark-spotted, thin, callous coat over the suture. The varieties may be thus defined :—

1. *A. Turneri* has the shell solid, white, with regular, rather broad, brown lines, rather oblique to the axis of the shell, with distinct sutural spots. This form I originally described as *Voluta Turneri* many years ago.

2. *A. T. Jamrachii* is very like the former; but the shell is thinner, the stripes are narrower and further apart, and the spots on the sutures are very small or absent.

We have had two specimens of this variety in the British Museum since 1859; and more lately, Mr. Jamrach has sent me five or six specimens, of different sizes, to examine, which he had received from North Australia. Some of the specimens are larger and rather more ventricose than any of the typical form that I have seen. The two specimens of this variety in the Museum have the suture rather impressed; but I believe this is only an accidental circumstance.

3. *A. T. Broderipi.* The shell solid, and like No. 1; but the streaks are very narrow, linear, and more or less acutely sinuated, sometimes anastomosing and forming a network.

There are two specimens of this variety in the Museum—one from Mr. Broderip's collection.

4. *A. T. Damonii.* Shell with close angular intersecting lines, forming crowded triangular spots on the surface; the sutural callosity very dark.

This shell, which was sent to the British Museum by Mr. Damon, is marked much like *Oliva texturata.* It differs from *Amoria reticulata,* with which it has been confounded, in the shell being less ventricose.

5. *A. T. Cumingii.* Like the former; but the netted lines are much firmer, and there are two spiral series of small irregular spots.

A small specimen in the British Museum collection, the most beautiful variety of the series, received, in 1859, with *A. T. Jamrachii,* as *Voluta pertusa.*

6. *A. T. maculata.* Shell pale brown, with two spiral series of large squarish dark spots, and a series of large irregular spots near the suture. (*Voluta maculata,* Swainson, Zool. Illust. t. .)

7. *A. T. pallida.* Shell pale brown, nearly uniform in colour, but sometimes marked with more or less distinct brown spiral bands, or with transverse stripes or very obscure netted lines. (*Voluta pallida,* Gray.)

I am aware that some conchologists may be inclined to regard these varieties as species, though I have seen specimens which seem to unite all of them into one series: I have therefore chosen for them names by which they may be so designated.

On the Motory Phenomena of the Sponges. By N. Lieberkühn.

Of the movements hitherto observed in Sponges, some are concerned with portions of the skin and efferent tubes, and others with isolated cells.

During the contraction of the efferent tubes, the wall of these organs becomes thickened by shortening, and its surface becomes mamillated, allowing us to recognize the limits of cells which were previously indistinct. The movements of the integument consist in an approximation or separation of the parenchyma of the body, and also in the opening and closing of the pores of ingestion. The isolated cells are capable of changing their form, so as to present, for example, alternately a spherical and a stellate appearance. Hitherto no one has observed any displacement of cells; but movements of this

nature are described by Lieberkühn in his recent memoir on the *Spongillæ*.

The parenchyma of the body of the *Spongillæ* presents a very variable arrangement, whilst the siliceous skeleton retains the same characteristic form in all specimens. Sometimes the parenchyma exhibits a cavernous structure, containing cavities more or less isolated from each other, and connected either with the orifices of ingestion or with tubes of ejection; sometimes these cavities are replaced by a system of canals extending through a great portion of the Sponge, and opening directly into the tube of ejection; in this case a great part of the integument is destitute of orifices of ingestion. In other cases the cutaneous pores are dispersed in great numbers over the whole surface of the Sponge, and usually lead into a large cavity belonging to the system of ingestion. The walls of the partitions bounding these cavities bear vibratile apparatus. In other *Spongillæ* there do not exist membranous partitions bounding the cavities; but the body is traversed in all directions by trabeculæ of different thicknesses, which are often supported upon the integument. Some of these are completely smooth in appearance, and show no appreciable outlines of cells; the strongest bear vibratile apparatus: others are constricted like a necklace, being formed of a simple series of cells in juxtaposition. Others, again, are composed of several rows of cells, of which the limits are visible only at the surface (so as to resemble an epithelial coat) or only at the centre of the trabecula.

All these different appearances may be presented successively by one and the same *Spongilla*. Homogeneous parenchymatous partitions have contracted, under the eyes of M. Lieberkühn, into trabeculæ with a cellular structure and of a necklace-like form. On the other hand, he has seen neighbouring trabeculæ spread out and become united in such a manner as to form a membranous wall. The cavities open into one another, and separate again. Fragments of *Spongillæ* artificially detached prove that the cells of the parenchyma can unite in a few hours to form a cutaneous envelope.

The pores of ingestion are not characteristic of the integument, as perfectly similar orifices are seen to originate in the membranous partitions of the interior of the body. The tubes of ejection are the seat of very peculiar movements. The author has seen the cells of the innermost layer gliding up the wall of the tube, and again descending.

M. Lieberkühn has positively demonstrated a fact which has only been suspected since the observations of Laurent—namely, the reproduction of Sponges by spontaneous division. In individuals kept in vessels filled with spring water he has seen the body contract, and emit here and there processes, which soon became detached and glided over the vacant portions of the siliceous skeleton, and even upon the bottom of the vessel. This division appears only to take place in individuals which are nearly perishing. But the fragments thus set free continue to live, and in the course of a few weeks they have produced in their interior siliceous spicules and vibratile cilia.

In these fragments of *Spongillæ*, and in perfect individuals in a dying state, M. Lieberkühn has witnessed phenomena which might

readily give rise to mistakes. Cells of the animal detach themselves from the mass, and remain scattered all round it. Some of these are finally dissolved, but others (or, at least, bodies which cannot be distinguished from them in appearance) begin to emit very delicate transparent filaments, resembling those of *Actinophrys*. Some of these bodies even become encysted in the manner of *Actinophrys* and *Amœba*. From these, four or five monociliated Monads are sometimes seen to issue: these are capable either of creeping in the manner of *Amœba*, or of swimming by the agency of their flagellum. These creatures are sometimes present in such great number, in the interior of dying *Spongillæ*, that one might be led to regard them as masses of sponge-cells. We should then have to recur to Dujardin's notion that the *Spongillæ* were merely masses of *Amœbæ* inhabiting a sort of siliceous polypary. M. Lieberkühn, however, shows that these bodies form no integral part of the *Spongilla*, and that they appear also in great quantities in the ova of fishes and other animals when in course of perishing. But he does not settle the question whether the Monads are the embryos of these kinds of *Amœbæ*, or whether we are to consider them as parasites of these parasites. It is interesting to compare these facts with the observations made by Jæger upon *Hydra*. It has been asserted that these animals are capable of breaking up into little unicellular Amœbiform creatures, which on their part can reproduce the *Hydræ*. Is not this an analogous case of parasitism misinterpreted?—*Müller's Archiv*, 1863, p. 717; *Bibl. Univ.* June 20, 1864, *Bull. Sci.* p. 183.

On the Geographical Distribution of the Annelida. By A. De Quatrefages.

Having completed a work on the Annelida which will form a portion of Roret's *Suites à Buffon*, M. Quatrefages has communicated to the Academy of Sciences of Paris some remarks upon the geographical distribution of those animals. He observes that, although the imperfection of our knowledge of the species would render it premature to undertake any detailed investigation of the subject, it is possible to indicate certain general laws, some of which are of the more importance as they contrast strikingly with facts universally recognized in other groups. His results are as follows:—

1. The class of Annelida properly so called (*Annelida Errantia* and *Tubicola*) is in salt waters the *geographical term corresponding* to the land and freshwater class of *Erythræina* (*Lumbrici* and *Naïdes*).

2. The class of Annelida has representatives in all seas. This is also the case with the two orders of which it is composed (*Errantia* and *Sedentaria*); in this respect the group under consideration may be said to fall under the general rules.

3. This cosmopolitism appears to extend not only to the large genera which best reproduce the general type, but also to the most exceptional subtypes, and even to those genera which might be supposed to be most characteristic. In this respect the Annelida differ from all the other groups which have been investigated from a geographical point of view.

4. Hence it results that the Annelidan fauna does not appear to

present anything resembling *zoological regions*, or *centres of creation* characterized by one or more special types—regions and centres the existence of which has been demonstrated for most of the other classes of the animal kingdom.

5. The tendency to the diffusion of the genera and subgenera is counterbalanced by the tendency to restriction, which is no less distinct, in the species.

6. The number of species common to two continents, to two hemispheres, to the eastern and western seas bounding a continent, &c., if not absolutely *nil*, is always exceedingly restricted. The species of the same genus sometimes change at very small distances. The author has not found a single species to be common to the French Atlantic coasts and to the shores of the Mediterranean.

7. Marine currents may explain the rare exceptions to the law of the local restriction of species. Thus M. de Quatrefages found at Saint Jean-de-Luz the large West Indian *Eunice Rousseaui*, confounded by Cuvier with the *E. gigantea* of the Indian Ocean. This species had evidently been conveyed from the West-Indian seas by the Gulf-stream.

8. From the cosmopolitism of the types and the local restriction of the species, it is evident that the *corresponding geographical terms* must be sought only among the latter. These are indeed almost always found, even in the case of those species which are most remarkable for some peculiarity of organization &c.

9. The class of Annelida, as regards the perfection of the organism, does not present the differences in correspondence with the latitude which have been indicated in other groups, and especially in the Crustacea, by Milne-Edwards. Equality of organization is one of the most general laws of this group.

10. The nature of the coast has the most marked influence upon the development of the Annelidan fauna. Judging from known facts, granitic and schistose coasts are in general remarkably rich in species and individuals, whilst calcareous coasts are as remarkably poor in both respects.—*Comptes Rendus*, July 25, 1864, p. 170.

On a new Species of Turacus. By G. R. Gray.

A new species of the interesting genus *Turacus* has just been brought by the Rev. C. Livingstone from the Manganja Highlands of East Africa, where it was obtained at an elevation of 3000 or 4000 feet above the sea.

It approaches the *Turacus albocristatus* in its general appearance, but the crest differs in form, being as it were bicrested; viz. the plumes from the crown are long and narrow, thus forming a crest pointed posteriorly, while those on the occiput are very short and closely set upon it. All the plumes of both parts are tipped with white. The rest of the plumage is very similar to that of *T. albocristatus*; but the feathers of the back and wings are margined with shining golden green instead of bluish green, as is seen on the latter-mentioned species.

I propose the name of *Turacus Livingstonii*, as a slight acknowledgment of that gentleman's merit in adding so interesting a species to our knowledge of this showy genus.—*Proc. Zool. Soc.* Feb. 9, 1864.

THE ANNALS

AND

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[THIRD SERIES.]

No. 82. OCTOBER 1864.

XXVI.—*On the Antipatharian Genus* Gerardia. By M. Lacaze-Duthiers*.

The animals producing the polyparies to which Lamarck gave the names of *Gorgonia tuberculata* and *Antipathes glaberrima*, and for which Dr. Gray established the genus *Leiopathes*, have hitherto been unknown. The object of the researches which I now submit to the Academy of Sciences is the filling up of this gap in our knowledge, the definition of a new genus, and the precise determination of the objects described by the authors under the names which have just been cited.

M. Valenciennes having done me the honour of handing over to me the revision of the collection of *Antipathes* belonging to the museum, I have ascertained, by the examination of the tickets written by Lamarck himself, that this illustrious naturalist gave the name of *Antipathes glaberrima* to the denuded polypary of the same species that he called *Gorgonia tuberculata* when it bore the animal layer; that Dr. Gray created the genus *Leiopathes* for *Antipathes glaberrima*, Esper; and lastly, that Jules Haime has described this same species under the name of *Leiopathes Lamarcki*. On the other hand, I easily perceived that if Lamarck had distinguished by two different names one and the same thing in different states of preservation, he had, on the other hand, confounded two different things under the name of *Antipathes glaberrima*.

Without mentioning the names of *Zoanthus* and *Palythoa*, given in collections to specimens of *Gorgonia tuberculata*, Lamk., preserved in spirit and having their polypes expanded, it is easy to prove that great confusion exists with regard to these objects. However, it is just to add that this confusion is the necessary consequence of having for examination only specimens in various

* Translated from the Comptes Rendus, July 11, 1864, p. 861.

states of preservation; but, at the same time, everything is explained when we examine living animals, and see what they become by desiccation.

The *Antipathes glaberrima* of Esper and Lamarck is very distinct from the species of *Antipathes* proper; the genus *Leiopathes* of Gray may therefore be adopted for it. But we must avoid regarding as belonging to it the polypary of *Gorgonia tuberculata*, Lamk., whether denuded or covered with sarcosoma, as has been done by J. Haime. On the other hand, this Lamarckian species represents a very clearly defined type, which must be regarded as a genus for which a name is necessary; for it is not an *Antipathes*, and still less a *Gorgonia*; and its very smooth polypary, examined by itself, has alone led to its being looked upon as a species of *Leiopathes*.

The new genus *Gerardia* which I propose presents a set of positive characters which distinguish it at once from *Antipathes*, *Leiopathes*, and *Gorgonia*: its validity does not appear to me to be doubtful. As to the species, it will be convenient to retain for it the name given to it by Jules Haime.

At the commencement of its development, *Gerardia Lamarcki* spreads its zoanthodema, formed entirely of sarcosoma, upon other polyparies; at this time it is perfectly parasitic. Subsequently it covers these foreign bodies with its own polypary, and produces branches and twigs; from this period it becomes independent, and its parasitism ceases. This is the reason why we find in the centre of the thick trunks of its polypary the slender stems of *Muricea placomus*, *Gorgonia subtilis*, &c. A Crustacean which lives parasitically in the soft tissues sometimes has its carapace covered by the horny deposits of the *Gerardia*. The egg-cases of Sharks and Rays, the suspensory filaments of which have seized its zoanthodemata, are first of all covered by expansions of its sarcosoma, and then taken bodily into its polypary. It is only by long-continued researches that I have been able to recognize the true part that must be ascribed to this parasitism.

The anatomy of *Gerardia Lamarcki* possesses great interest in a scientific point of view. The bodies of the animals, like the intermediate tissue that unites them, are formed of two layers of cells: the inner one, which is yellow and granular, lines all the cavities, and is covered with vibratile cilia; the external layer, which is nearly colourless, is contractile and filled with bundles of nematocysts.

The polypes resemble young Actiniæ; they have twenty-four simple tentacles, arranged in two rows round the mouth, and the oblong and turned-up lips of the latter form a central mamilla. The number of tentacles is a multiple of six, and

Gerardia thus approaches *Antipathes* and *Leiopathes*; but the number in those genera, never exceeding six, separates it from them generically. The cavity of the body displays the same number of radiating folds, analogous to those of the polypes of other Corals.

A very abundant vascular network occupies the whole of the sarcosoma, and opens into the body-cavities of the polypes, which thus communicate with each other. A similar condition was already known to occur in the Alcyonaria, but has not previously been indicated in other groups of Corals. It leads us to suppose that an analogous arrangement exists in all the species living in colonies—that is to say, forming a zoanthodema.

The sarcosoma secretes a viscous and plastic fluid capable of agglutinating all small bodies which come into contact with it. Thus we find on the surface of *Gerardia* grains of sand and spicules of *Bebryces, Muriceæ, Gorgoniæ*, and Sponges which live beside it. It is to this, no doubt, that we must refer for the origin of Haime's opinion that his *Leiopathes Lamarcki* was a spiculigerous Antipatharian.

The reproductive organs are developed in the thickness of the radiating folds, behind the convoluted filaments, precisely as in the *Actiniæ*. The sexes are most commonly borne upon distinct polyparies; nevertheless both male and female polypes may be met with in the same colony. I have not seen any hermaphrodite polypes, but it would not be surprising if such should exist.

In the form of its polypes *Gerardia* much more closely resembles the Actiniadæ than the Alcyonaria. This approximation, established by Dana for two species of *Antipathes*, and accepted by Milne-Edwards and Haime, is therefore confirmed in this case by a minute investigation which cannot leave room for any doubt; for *Gerardia* is much more nearly related to the Zoantharia than *Antipathes*.

XXVII.—*Descriptions of new Species of Fluviatile and Terrestrial Operculate Mollusca from Trinidad.* By R. J. Lechmere Guppy.

§ 1. *Fluviatile Species.*

Ampullaria purpurascens, n. sp.

Shell ovate, narrowly perforate, rather thin, subopaque, simply horn-coloured, or purplish with numerous indistinct darker purple bands; striated by close lines of growth, which are crossed at right angles by more distant, interrupted, low,

spiral ridges; epidermis pale olive or horn-colour, closely covered with minute striæ; whorls 6, convex above, the last rather flat laterally; suture well impressed; spire convex-conic; aperture narrow, ovate; peristome acute, its margins joined by a thin callus spread over the penultimate whorl; right margin slightly reflected, columellar margin white, expanded and reflected over the narrow umbilicus. Operculum ovate, horn-coloured, concentrically striate; nucleus near the sinuate inner margin. Height 2 inches, greatest breadth 1·4 inches.

The *animal* is nearly black, with a very long siphon. It bears a close resemblance to the animal of *A. guianensis*. The present species is rarely found in a state of perfection: those occurring in ponds are usually dwarfed and distorted.

The present shell differs from *A. Chemnitzii*, which it somewhat resembles, in its greater height of spire and in the narrower and more ovate form of the shell. The aperture also is narrower, and the peristome less expanded.

There is an *Ampullaria* to be found in some parts of Trinidad which seems to be a variety of *A. effusa*, Chemn. (*A. glauca*, Linn.), with a tall spire. It presents the same variations of colour as *A. effusa*, some examples being zoned with dark bands, and others being simply of a brownish olive without colour-bands.

Ampullaria effusa is found existing in many of the streams of the island. Its eggs are deposited, in masses of fifteen or twenty, on trees or rocks just out of the water. They are of a bright green colour; but when the young mollusks come forth, the calcareous covering of the eggs remains of a white colour. The young mollusk has a shell of 2½ whorls, nearly similar to that of the adult, but quite imperforate.

Bithinia spiralis, n. sp.

Shell small, oblong-conic, imperforate, dark reddish brown, smooth, spirally striate, or ornamented on the upper part of the whorls with a keel bearing a regular series of somewhat aculeate rather moniliform projections, giving to the whorls a sharply angulate appearance, and disappearing on the last whorl; whorls six, little convex, gradually increasing, the last forming nearly half the shell; apex conic, sharp; aperture perpendicular, ovate; peristome simple, acute, the margins joined by a thin callus spread over the penultimate whorl; columellar margin narrow. Operculum thin, horny. Height 0·18 inch, greatest breadth 0·11 inch.

The *animal* has a long, divided muzzle, at the base of which

are the two tentacles with the eyes close behind them. The foot is produced in front into two acute lobes.

It may seem strange that so much variation should exist in a single species—from a shell with smooth whorls to one with whorls bearing a keel ornamented with aculeate projections; but there does not exist in my mind the smallest doubt of the different forms belonging to the same species. All the forms are found existing together in the streams of northern Trinidad.

Valvata agglutinans, n. sp.

Shell trochiform-depressed, perforate, entirely composed of numerous minute grains of mineral matter; whorls 3–4, almost carinate, flattened beneath; umbilicus circular; aperture very oblique, circular, the margins shortly united on the penultimate whorl; peristome simple, irregular. Height 0·1 inch, greatest breadth 0·17 inch.

This very curious little *Valvata* makes its shell almost entirely of minute particles of quartz and mica, the cementing material being very limited in amount. It lives on the surface of rocks and stones in the hill-streams of the northern part of Trinidad.

§ 2. *Terrestrial Species.*

Cyclotus trinitensis, n. sp.

Shell depressed, turbinate, rather thick, white under a pale-brown epidermis, with fine wavy lines of growth, and sometimes with obsolete white or chestnut bands; spire somewhat acuminate; whorls 5, convex; umbilicus broad and open; aperture slightly oblique, nearly circular; peristome blunt, its margins forming an angle above; right margin slightly sinuate. Operculum concave, with six obliquely striate whorls, the inner margins of which are raised. Height 0·55 inch, greatest breadth 0·9 inch.

The *animal* is of a pinkish colour, which is most pronounced about the tentacles. The eyes are small and black. The mouth is provided with an amber-coloured, somewhat triangular mandible, divided into two parts by a median fissure, from which diverge slightly curved rows of minute denticulations strongly resembling the lingual teeth of some Helicidæ.

The lingual teeth are 3 . 1 . 3, in arched rows: central broad, tridentate; 1st lateral broad, bidentate, with a base much produced outwardly; 2nd tridentate; 3rd much hooked and reflexed, tridentate. This dentition is very like that of *Cyclophorus Tuba* (Gray, Syst. Dist. Moll. p. 78).

This species is readily distinguished from *C. jamaicensis* by its light colour and by the absence of any ridge round the um-

bilicus. It is not a common shell on the main island of Trinidad; but it is found in abundance on one of the rocky islets of the group called the Coloras, or Five Islands, in the Gulf of Paria. In aged examples the epidermis is frequently quite wanting, and the aperture is much thickened and wrinkled.

Cyclotus rugatus, n. sp.

Shell depressed-turbinate, with a strong reddish-brown epidermis, zoned with several narrow, obsolete lighter bands, and closely covered with fine angular wrinkles, which almost disappear at the aperture; spire short, depressed; whorls 4, rather flattened above, convex and rounded beneath; umbilicus broadly open; aperture nearly vertical, circular, with a slight angle above; peristome straight, blunt, its margins joined into an angle, right margin not sinuate. Operculum testaceous, and concave externally, internally cartilaginous, with about seven narrow obliquely striated whorls, the inner margins of which are raised. Height 0·4 inch, greatest breadth 0·7 inch.

The *animal* of *C. rugatus* is of a pink colour, strongest about the tentacles. The lingual teeth do not present any remarkable differences from those of *C. trinitensis*, except that the outer laterals are bidentate (not tridentate), thus more closely approaching *Cyclophorus Tuba*.

This very distinct species is found among the northern hills of Trinidad, ranging to an altitude of 2500 feet. It has fewer whorls, a much more depressed spire, and an operculum with narrower and more numerous whorls than *C. trinitensis*; and in the angularly wrinkled character of its epidermis it approaches *C. corrugatus*.

Adamsiella aripensis, n. sp.

Shell oblong-turreted, narrowly perforate, scarcely truncate, rather thin, crowdedly folded longitudinally, dark reddish brown, often with several darker interrupted bands, and about three spiral ridges round the narrow umbilicus; spire regularly tapering, scarcely truncate; suture deep, simple; whorls remaining 6, convex, enlarging gradually; aperture vertical, ovate; peristome orange or pale, double, concentrically striate, dilated above; inner edge waved, rather emarginate on the penultimate whorl; outer edge slightly waved. Operculum ovate, rather cartilaginous, with about four gradually enlarging whorls, the outer edge of which is detached. Length 0·65 inch, greatest breadth 0·3 inch.

This handsome species is found on the Cerros of Aripo, in the northern hills of Trinidad, at an elevation of from 2000 to

2700 feet. The *animal* has a rather elongate grooved foot. Lingual teeth 00.2.1.2.00: central tooth broad, simple; inner lateral broad; outer lateral broad, denticulated on the reflexed edge; uncini numerous, slender, curved at the tip. The lingual dentition is thus shown to differ considerably from that of *Cyclophorus.* While the central and lateral teeth present a certain resemblance to those of *Cyclophorus,* the uncini remind one of *Trochus, Nerita,* and especially *Helicina.* The teeth of *Adamsiella aripensis* also resemble those of *Cistula pupiformis,* which I have examined; but in the latter there are no uncini.

The shell of the present species is occasionally found without its spire having suffered the usual slight truncation.

Helicina zonata, n. sp.

Shell subglobose-conic, thin, smooth, whitish, bright straw-coloured or pinkish; suture with a chestnut or red band which becomes quite obsolete on the last whorl, and sometimes a broader yellow or pinkish band on the last whorl; spire conic, mucronate; apex deep red; whorls 5, convex, rather carinate, flattened beneath; aperture oblique; columella terminating in an indistinct knot dilated backwards into a thin circumscribed callus; peristome thin, white, expanded and reflected. Operculum rather shelly, deep blood-red, except at the nucleus and extreme margin, which are horn-coloured diaphanous. Height 0·27 inch, greatest breadth 0·42 inch.

Lingual teeth 00.3.1.3.00: central subquadrate, narrowed at the base; 1st lateral subopaque, subtrapeziform, with the outer corner much produced; 2nd lateral subopaque, elongate, strongly curved outwardly; 3rd lateral broad, convex, glossy, denticulate on the reflexed edge; uncini numerous, slender, with the curved tips finely denticulate. The peculiarities of the lingual dentition of *Helicina* would seem to have been overlooked. The numerous uncini and the subopaque trapeziform laterals remind us strongly of *Nerita,* and would seem to give some support to the idea of the close relationship of these genera—an idea which is further supported by the resemblance of the shells of the two genera.

Helicina barbata, n. sp.

Shell globose-turbinate, thin, smooth, zoned with about three chestnut or red bands, covered with a hairy periostraca; spire depressed-conic; whorls 5, convex, flattened beneath; aperture oblique, semilunar; columella terminating in an indistinct knot dilated backwards into a thin callus; peristome narrowly expanded; right margin slightly sinuate above. Operculum thin, concave, pale, diaphanous, blood-red towards

the outer margin. Height 0·2 inch, greatest breadth 0·32 inch.

This shell resembles *H. pudica*, Drouet, in shape, but is much larger. It is also distinguished by the bands of colour. It is, with *Achatina octona*, the commonest of land shells in Trinidad, and it is the only species of mollusk I have ever observed on the guava (*Psidium pomiferum*), a plant which is shunned by most animals on account of its strong aromatic taste and smell.

The foot of the *animal* is acutely pointed behind; the eyes quite sessile on the outer side of the tentacles, which are long and obtusely pointed. The hairy periostraca of the shell readily comes off, and is rarely seen in cabinet examples.

The lingual dentition is 00.3.1.3.00. The lingual teeth of this species closely resemble those of *H. zonata*, which I have already described; but in *H. barbata* the two inner laterals are glassy and pellucid. The central tooth is broader, and seems to be divided longitudinally. The minute slender uncini are probably about fifty, becoming almost indistinguishable towards the edges of the dental band.

It is my intention to forward to the British Museum the types of the species here described so soon as this communication shall have been made public.

Port of Spain, Trinidad.
August 2, 1864.

XXVIII.—*On the Asserted Occurrence of Flint Knives under a Skull of the extinct* Rhinoceros hemitœchus, *in an Ossiferous Cave in the Peninsula of Gower*. By H. Falconer, *F.R.S., &c.*

To the Editors of the Annals of Natural History.

Gentlemen,

In the important memoir by MM. Lartet and H. Christy, on the Ossiferous Caves of the Périgord, a statement occurs on the above head which demands correction by me. After commenting on the proofs of the co-existence of Man with certain extinct species, such as *Elephas primigenius, Rhinoceros tichorhinus*, &c., M. Lartet adds the following passage:—

"Cette hypothèse de la contemporanéité humaine s'étendrait même à une autre espèce d'éléphant (*E. antiquus*, Falc.) dont l'extinction est réputée plus ancienne encore. Les restes de cet éléphant ont été recueillis, en France, à Saint-Roch, près Amiens, à Clichy, près Paris, et à Viry-Noureuil (Aisne), dans des assises diluviennes ou quaternaires renfermant aussi des silex taillés de main d'homme. On n'a pas, que nous sachions, encore observé

l'*Elephas antiquus* dans les cavernes de France; mais en Angleterre, dans la presqu'île de Gower (pays de Galles), il a été trouvé, dans plusieurs cavernes explorées par le docteur Falconer et le colonel Wood. Il y était associé avec un rhinocéros (*R. hemitœchus*, Falc.) d'espèce également ancienne; *et, dans la caverne de* Long Hole, *plusieurs silex taillés ont été rencontrés sous une tête de ce dernier rhinocéros*"*.

As his authority for the statement contained in the two last lines of the foregoing extract, given in italics, M. Lartet cites Sir Charles Lyell ('Antiquity of Man,' 3rd edit., Appendix, p. 513, 1864); and on referring to that work, I find the following sentence:—"In Bosco's Den no human bones or implements were discovered; but in the neighbouring cave, called Long Hole, where the same zealous explorer" (Colonel Wood) "detected flint knives beneath the skull of *Rhinoceros hemitœchus*, several fossil bones have been obtained which exhibit transverse and other cuts like those which M. Desnoyers would ascribe to human handiwork" (*op. cit.* p. 514).

M. Lartet's great eminence as a palæontologist, and the leading share which he has had in bringing to light and investigating, with such truth and sagacity, the evidence respecting the antiquity of human relics in France, are calculated to give weight and currency to any statement adopted on trust and repeated by him without verification. In this instance he has been gravely misled by the authority on which he relied. No skull of *Rhinoceros hemitœchus* above flint knives was ever discovered by my friend and fellow-labourer Colonel Wood in 'Long Hole' cave, nor was any skull of that extinct species ever found in it. The flint implements which he found there, together with the immediately associated fossil remains, were at the time transmitted to me for investigation, and out of my hands they have never passed. They have been shown by me to several men of science, including Sir Charles Lyell. A detached shell of a milk molar of *Rhinoceros hemitœchus* was among the number: hence, probably, the origin of the assertion about the skull,—a small milk molar having been exalted into a skull found *above* flint implements, doubtless from inadvertence, misconception, or error of recollection.

The evidence of man having been a cotemporary of the earliest of the extinct mammals of the Quarternary period is sufficiently beset with difficulties, without being further perplexed by supposititious facts or exaggerated statements. Hence the necessity of this correction.

21 Park Crescent, Portland Place,
June 28, 1864.

* Revue Archéologique, 1864, "Sur des figures d'Animaux gravées ou sculptées," &c. p. 265. Separate edition, "Cavernes du Périgord," p. 35.

XXIX.—*Observations on Raphides and other Crystals.* By George Gulliver, F.R.S.

[Continued from p. 56.]

Quillajeæ.—The crystals in the wood or bark of *Quillaja saponaria*, which were long ago well described by Edwin Quekett, are very characteristic of the genuine article. In a sample from Messrs. Butler and M'Culloch, I find these crystals lying in great numbers along the liber and mesophlœum. They are commonly about $\frac{1}{100}$th of an inch long and $\frac{1}{1000}$th thick, four-sided rectangular prisms, each of the faces equal, and the ends tipped with short pyramids. But they vary in form. Their ends may be like the edge of a chisel or wedge, and occasionally as if the shaft of the crystal had been cut through obliquely from one angle or face to the opposite one; besides, the prisms may be triangular. Though they are so very plentiful, they occur for the most part singly, sometimes two or three partially fused together, and never in bundles, in which characters they further differ from true raphides, and closely resemble many of the crystal prisms of Iridaceæ and some other Monocotyledones ('Annals,' Sept. 1863 and April and May 1864). Quekett describes each separate prism of *Quillaja* as having a close investment or cell, but no loose one, of cellulose.

Melastomaceæ.—A species of *Melastoma*, at Redleaf, affords an abundance of sphæraphides in the endophlœum and mesophlœum, but no raphides either in the bark or leaves.

Crassulaceæ, Ficoideæ, and *Cactaceæ.*—A complete examination of these orders would be interesting and useful. Among the few species formerly examined ('Annals,' May 1864) raphides were always found abundantly in *Mesembryanthemum*, and never at all in Crassulaceæ and Cactaceæ, although sphæraphides and short four-sided prisms were seen to abound in the last-named order. These prisms sometimes appeared either abruptly truncated, tipped with low pyramids, or with the ends as described in Quillajeæ, &c., the tips commonly forming a part and projecting on the surface of the sphæraphides. Lately I have again examined the plants already specified, and a few others, to wit, *Sedum speciosum, S. Fabaria, Epiphyllum Russellianum, Cereus crenatus*, and two species of *Mesembryanthemum.* The result was still the same—a profusion of raphides in Mesembryeæ, and none in Crassulaceæ and Cactaceæ. Raphides were seen abundantly in the corolla, style, and ovary, but not in the stamens and ovules, of *Mesembryanthemum tricolor*, and in the petals and filaments of *M. tortuosum.* In these last two parts, and in the ovary and pistil, the raphides were smaller and more fragile than in the leaves and stem; and, as I have described in other spe-

cies, bundles of these minute raphides swarmed in the seed-leaves, plumule, and caulicle of *M. tricolor*.

Tetragonieæ and *Sesuvieæ*.—Having, thus far, always found a profusion of raphides in the section Mesembryeæ, the question arises whether this character also be possessed by the other two sections of the order Ficoideæ. Accordingly specimens, either fresh or dried, were examined of the leaves and stalks of four species of *Tetragonia*, three of *Aizoon*, and three of *Sesuvium*; and the result was a negative answer to the question. No raphides were found in any of these ten plants, though in several of them sphæraphides were observed in more or less abundance —a character in which Tetragonieæ and Sesuvieæ resemble Chenopodiaceæ. In the leaves, calyx, and ovary of *Tetragonia expansa* the sphæraphides are about $\frac{1}{800}$th of an inch in diameter, and commonly double that size in the pith.

Plantaginaceæ, *Nyctaginaceæ*, and *Amaranthaceæ*.—These orders are numbered 143, 144, and 145 in Prof. Balfour's 'Manual of Botany.' I have only examined three species belonging to the central order, and they all abound in raphides, which were seen in the flower and swarming in the leaves and stem of *Oxybaphus violaceus*, and in the stem, bracts, and different parts of the flower of *Bougainvillæa glabra*. And I have never failed to find raphides equally abundant in the root-stock, leaves, calyx, and corolla, and also, but smaller and more tender, in the stamens, pistil, ovary, ovule, spermoderm, and seed-leaves of *Mirabilis*. On the contrary, in the few species examined belonging to the neighbouring orders, Plantaginaceæ and Amaranthaceæ, no raphides were found.

Chenopodiaceæ, *Phytolaccaceæ*, and *Polygonaceæ*.—Here again arises the question, how far an order may be distinguished by raphides from its allies. Does this small central order differ as a raphis-bearer from the two larger neighbouring orders? Of Phytolaccaceæ I have only examined the leaves, red petioles, and midribs of *Phytolacca icosandra*, and the leaves, young flowers and buds, spike and bracts of *P. esculenta*, var. *venosa*, in all of which raphides occur profusely. But this character was found entirely wanting in every one of the few species or varieties of *Chenopodium*, *Atriplex*, *Beta*, *Rheum*, *Rumex*, and *Polygonum*, which were examined at the same time for comparison. Sphæraphides, indeed, are very common in Chenopodiaceæ, as may be well seen in the leaves, stem, pith, and mesophlœum of common garden weeds of the Goosefoot family, and, as is well known, in some parts of certain Polygonaceæ. In *Chenopodium* and *Atriplex* most of the sphæraphides are about $\frac{1}{600}$th of an inch in diameter, and others are much larger.

I am indebted to the kindness of Mr. De Carle Sowerby,

Mr. W. H. Baxter, and Mr. Cox for the names of, and opportunities of examining, many of the exotic plants mentioned in this paper.

Edenbridge, Sept. 10, 1864.

[To be continued.]

XXX.—*On the* Menispermaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 103.]

15. Tiliacora.

This genus was first proposed by Colebrook, in 1819, for the *Menispermum polycarpon*, Roxb.; but, as he was unacquainted with its carpological features, the genus was not adopted by subsequent botanists. DeCandolle, in his 'Prodromus' (1824), did not recognize it; for he named the same plant *Cocculus acuminatus*: from that time it continued unnoticed until 1851 (Ann. Nat. Hist. ser. 2. vii. 36), when I first pointed out the identity of the two plants, and described the structure of the seed; and this at once established the validity of *Tiliacora*. This genus, peculiar to Asia, is represented in the New World by *Abuta*, *Batschia*, and *Anelasma*: all nearly correspond in their floral structure, and resemble one another in the remarkable development of the seed—features which entitle them to rank in a distinct tribe, the *Tiliacoreæ*. It is surprising that the authors of the 'Flora Indica' and of the 'Genera Plantarum' have refused to acknowledge the validity of this very natural group, and have placed these genera in the same tribe with *Cocculus*, thus mingling in confusion genera with a very ruminated albumen and a very slender embryo having incumbent cotyledons as much attenuated as their very slender radicle, with other genera having a simple albumen and an embryo with accumbent, broad, foliaceous cotyledons—characters perfectly irreconcileable in any arrangement that lays claim to consistency.

The flowers in this genus, though usually diœcious, are sometimes polygamous; they have nine to twelve sepals in ternate series, the three internal ones being much larger, and valvate in æstivation; they have six minute petals appearing like nectarial scales, and six stamens placed opposite to them, all inserted together upon a short columnar receptacle, on which three punctiform rudimentary ovaries are placed. In the numerous specimens of *Tiliacora* that I have seen, I have not yet found a female flower; I have, however, met with two species in which they are polygamous: in one case there are six petals, only three stamens,

and three ovaries of equal length, oblong, ventricose, 1-celled, with a single appended ovule, and terminated by a subulate style; in the other case the flower has six petals, six stamens, four minute gibbously oval ovaries in the centre, with an obsolete style, and these are 1-celled, with a regular ovule. Roxburgh, who is the only authority, states that the female flower has sepals and petals similar to those of the male; but he mentions no stamens: he adds that it has twelve ovaries in a single whorl, each terminated by a subulate style, thus agreeing with those I have described; of these twelve ovaries as many as eight or ten often come to perfection, but sometimes four, or even fewer, are matured: they are all borne on the summit of a cylindrical gynæcium, which increases in length and thickness with age, and on its summit are seen the cicatrices of the abortive ovaries, while all those that have been fertilized are carried up, each on a separate elongated ligneous fork, which grows out of the gynæcium, the fruits as they ripen being articulated on them: these radiating carpophori are solid emanations from the gynæcium itself, and form no part of the ovarial increment. This is a very remarkable feature in *Tiliacora*, being analogous to a similar growth which I have described in *Anamirta* and *Sciadotænia*. It is probable that in different species of *Tiliacora* the number of ovaries may vary; but hitherto we have no evidence on the subject. In the development of the ovary, the growth is almost entirely on the dorsal side, and is so extremely excentric that, at maturity, the styles all connive towards the centre, in close proximity to the basal points of attachment of the drupes, which radiate horizontally round the gynæcium. It is not necessary to repeat here the peculiar features connected with the development of the putamen and seed, as they have been sufficiently explained; it remains, therefore, only to give a more full diagnosis of the genus.

Tiliacora, Coleb.—*Flores* dioici vel interdum polygami. *Masc. Sepala* 9–12, in ordine ternario alternatim disposita; exteriora gradatim minora et bracteiformia; 3 interiora multo majora, obovata, subcarnosa, æstivatione valvata. *Petala* 6, minima, carnosula, cuneato-oblonga, subbiseriata. *Stamina* 6, subæqualia, petalis 3–4-plo longiora et opposita, libera; *filamenta* gracilia, apice incrassata; *antheræ* 2-lobæ, introrsæ, lobis oblongis, dorsaliter semi-immersis, apice contiguis, imo paulo divaricatis, rima obliqua longitudinaliter dehiscentibus. —*Fl. hermaphr. Sepala* et *petala* maris. *Stamina* 3, petalis alternis opposita, mole maris, pollinifera. *Ovaria* 3, gynæcio insita, erecta, oblonga, imo tenuiter stipitata, dorso ventricosa, 1-locularia, *ovulo* unico (an fertili ?) ad faciem ventralem medio

appenso. *Stylus* subulatus, tenuiter elongatus, apice uncinato-incurvatus. *Stigma* obsoletum.—*Fl. fœm.* (sec. Roxb. *sepala* et *petala* maris; *ovaria* 12, in unica serie gynophoro insita; *stylus* subulatus; *stigma* simplex). *Drupæ* 3–6, vel usque ad 12, valde gibboso-obovatæ, compressæ, in summo *carpophororum* totidem e gynæcio cylindrico enatorum suffultæ et articulatæ, hoc modo radiatim horizontales, singulæ stylo persistente imo proximo notatæ; *putamen* oblongum, compressum, imo truncatum, hinc ultra medium utrinque sulcatum, coriaceum, 1-loculare, *condylo* interno septiformi transversali ultra medium protenso, siccitate 2-marsupiatum, intus læve, 1-spermum; *semen* loculo conforme, 2-crure; *integumenta* membranacea, tenuia, inter rimas albuminis plicata, et per *raphen* ad condylum affixa; *embryo* elongatus, teres, intra *albumen* copiosum undique transversim et anfractuose ruminatum hippocrepice inflexus, cotyledonibus subcompressis, incumbentibus, *radiculæ* tereti æquilatis et 3-plo longioribus, hac in locello superiore ad stylum spectante, illis in inferiore ad hilum tensis.

Frutices *scandentes Asiæ intertropicæ et insularum;* folia *oblongo-ovata, glabra, 3-nervia, et sæpe triplinervia;* racemi *subpaniculati, axillares, solitarii vel gemini.*

The following species will be described in the third volume of 'Contributions to Botany':—

1. *Tiliacora racemosa*, Coleb.;—T. acuminata, *H. & Th.*;—Cocculus acuminatus, *DC.*;—C. radiatus, *DC.*—India orientalis.
2. —— *fraternaria*, nob.—Ceylon.
3. —— *cuspidiformis*, nob.;—T. acuminata, *H. & Th.* (*in parte*).—Ceylon (Thwaites, 1056).
4. —— *abnormalis*, nob.—Ind. orient.

16. Abuta.

In 1851 I endeavoured to establish the characters of this previously obscure genus, which had been fused into *Cocculus*, when I referred to it several plants from Guiana and Brazil, which approximate in habit and general structure to Aublet's typical species, *Abuta rufescens*. The leaves are generally of large size, broad, often cordate at base, smooth above, and covered beneath with dense yellowish tomentum, with very prominent digitate nervures, externally branched, and with strong transverse veins. The inflorescence is in long, pubescent, axillary racemose panicles, and its drupaceous fruits, densely tomentose, contain an oblong coriaceous putamen, with a bimarsupiate cell, enclosing a single hippocrepiform seed, having an

albumen ruminated by numerous fissures, and enclosing an embryo much resembling that of *Tiliacora*.

Prof. Grisebach endeavoured to show, in 1858 (Journ. Proc. Linn. Soc. iii. 108), that *Abuta, Batschia*, and *Anelasma* constitute a single genus (*Abuta*), of which he then gave a new generic character in order to embrace the whole; he there confirmed the facts I had stated showing their close relation to *Tiliacora*; but at the same time, following the example of the authors of the 'Flora Indica,' he referred both *Abuta* and *Tiliacora* to the tribe *Cocculeæ* of those botanists. In doing this he quite forgot the very important difference between the two opposite conditions of a deeply ruminated and a simple albumen, which are respectively found in the two tribes thus confounded together; also the very different forms of their embryo, and more especially the distinction that, in the one case, the cotyledons are accumbent, in the other incumbent—circumstances which render the one group essentially incompatible with the other.

In 1861 Mr. Bentham published his "Notes on *Menispermaceæ*" (Journ. Proc. Linn. Soc. v. Suppl. p. 45), when he adopted the example of Prof. Grisebach in amalgamating *Batschia* and *Anelasma* with *Abuta*, and in a sweeping manner annulled most of the species I had indicated, reducing each of the genera thus fused together to little better than the condition of a single species.

Messrs. Bentham and Hooker, in their 'Genera Plantarum,' regardless of the peculiar structure of the seeds, persist, as before stated, in placing *Tiliacora* and *Abuta* (including *Batschia* and *Anelasma*) in the same tribe, and in juxtaposition with *Cocculus*.

Finally, MM. Triana and Planchon agree with Dr. Grisebach in associating into one all the three genera in question.

The difficulty of reversing the decisions of these united authorities is necessarily great, but perhaps not insurmountable. I will therefore venture, in a few words, to show the differences existing between *Abuta* and *Anelasma*. There exists among the individuals forming these groups a very different habit, a notably distinct appearance in their leaves, and a dissimilar character in their inflorescence—features so striking as to render it almost impossible, with a mere glance at the plants, to mistake one genus for the other. In *Abuta* the midrib of the leaves beneath, as well as the lateral ramifications, have externally strong, prominent, pinnate nervures, which are absent in *Anelasma*; the leaves are all densely tomentose beneath, with a few exceptions, where they become glabrous with age; but even in that case the distinction is maintained by the branches, petioles, and racemes, which are thickly tomentose, while in *Anelasma* the same parts are quite glabrous. In *Abuta* the inner sepals are exter-

nally sericeous, very fleshy, and valvate in æstivation; in *Anelasma* the corresponding sepals are glabrous, more membranaceous in texture, and (though slightly) are decidedly imbricated in æstivation. In *Abuta*, in the male flower, each stamen bears a 2-lobed anther, the lobes separated from one another by a deep longitudinal channel or by a broader interval, and attached by their entire length to a broad filament; each lobe opens laterally by a vertical or oblique fissure: in *Anelasma* each stamen bears only a single globular anther, apicifixed upon, and half immersed in, the summit of a broad fleshy filament, bursting across its apex by a transverse gaping fissure into two valves, antical and postical, and divided inside by a septum parallel to the valves, as is well shown in Pöppig's figure. In the female flower, the structure of the sterile stamens in *Anelasma* is different: the ovaries are quite glabrous, with a different stigma, while in *Abuta* and *Batschia* the ovaries are densely pilose; the drupes in the two latter cases are thickly tomentose, while in *Anelasma* they are quite glabrous. In the case of larger flowers, such differences as I have indicated would not fail to be recognized in their full importance, and there can be no justification for ignoring them, or considering them as too trivial, on account of their diminutive size. Here assuredly there is sufficient evidence to show that *Anelasma* ought not to be confounded with *Abuta*; but other differences will be seen when we come to speak of *Anelasma*.

Until lately, I had maintained *Batschia* as an independent genus, distinguished from *Abuta* by its stamens, which are rigidly hispid, while the small globular cells of the anthers are separated by a much wider interval, and laterally imbedded in a very thick filament, sometimes so deeply as to be invisible from the front; and, furthermore, the species have glabrous leaves. As these characters sometimes run into one another, I have now retained *Batschia* as a section of *Abuta*, distinguished by the characters just mentioned. In *Batschia*, although the leaves are glabrous and generally smaller, they accord with *Abuta* in their ramified nervation, in which respect *Anelasma* differs from the whole group. All the species of *Abuta* seem to be scandent plants, while those of *Batschia* appear to be erect shrubs. When these plants are better known, I think it very likely that *Batschia* will establish its right to rank as a distinct genus.

While this paper is in the printer's hands, I have received from Dr. Eichler the 25th Number of the 'Ratisbon Flora' (July 1864), giving an abstract of his arrangement of American *Menispermeæ*, already printed for Prof. von Martius's 'Flora Brasiliensis.' Dr. Eichler has there adopted the views of other bota-

nists which I have just combated, in uniting *Anelasma* with *Abuta*: he divides this genus into four sections,—(1) *Butua* (or *Abuta* proper); (2) *Batschia*; (3) *Anelasma*; (4) *Corynostemon*, which is founded on the plant I have here described as *Abuta* (*Batschia*) *acutifolia* (Spruce, 2763), and which I placed in that section on account of its hairy stamens. I have shown that the stamen of this species differ in no respect from those of *Batschia racemosa* and *A. Seemanni*, except in the greater breadth of the filament in the three inner stamens: the section *Corynostemon* will therefore hardly be received as a valid one, as my analyses* will show. In regard to the determination of the several species of *Abuta*, I regret to differ as much with Dr. Eichler as with those botanists whose example he has adopted. The characters on which I have endeavoured to establish the species, according to the list that follows, are given at full length in my 'Contributions to Botany,' now in type.

Abuta, Barrère, Aublet.—*Flores* dioici. *Masc. Sepala* 9, in ordine ternario alterna, 6 exteriora bracteiformia, linearia, 3 interiora majora, deltoidea, acuta, concava, extus sericeo-tomentosa, æstivatione valvata, apice inflexa. *Petala* nulla. *Stamina* 6, libera, subbiseriata, subæqualia, andrœcio brevi insita, sepalis opposita; *filamenta* subcarnosa, suberecta, apice incrassata, inflexa, et conniventia, glabra vel pilosa, 3 interiora latiora; *antheræ* 2-lobæ, lobis discretis, ovatis, subparallelis, ad filamentum utroque latere omnino adnatis, singulis rima marginali longitudinali dehiscentibus.—*Fœm. Sepala* 6, ut in mare. *Petala* nulla. *Stamina* sterilia 6, æqualia, *filamenta* filiformia, subincurva, ovariis æquilonga, glabra aut pilosa, interdum clavata et hinc apice glandulis 2 minutis signata, gynæcio villosissimo affixa. *Ovaria* 3, libera, sepalis interioribus opposita, dense sericea, 1-locularia; *ovulum* solitarium, subincurvum, supra medium faciei ventralis funiculo brevi suspensum. *Stylus* brevissimus, teres, subexcentricus. *Stigma* carnosum, deltoideo-obliquum, in lobos 3 digitatos laciniatum. *Drupæ* 3, vel abortu pauciores, magnæ, siccæ, valde tomentosæ, horizontaliter oblongæ, breviter stipitatæ, styli vestigio prope basin notatæ; *putamen* oblongum, subcompressum, utrinque ultra medium sulcatum, coriaceum, 1-loculare, *condylo* septiformi sulcis apposito e basi ultra medium loculi protenso, proinde 2-marsupiatum, monospermum; *semen* loculo conforme, bicrure; *albumen* copiosum, carnosum, fissuris numerosis anfractuosis irregularibus profunde ruminatum, *integumentis* laxis tenuissimis intra fissuras plicatis cinctum; *embryo* tenuis, teres, hippocrepice inflexus, centro

* These will be figured in my 'Contributions to Botany.'

albuminis immersus, *cotyledonibus* incumbentibus, *radicula* supera ad stylum spectante longioribus.

Frutices *Americæ intertropicæ volubiles,* ramulis *tomentosis*; folia *orbicularia vel ovata, subacuta, imo sæpe cordata, supra glabra, subtus tomentosa,* 3–5-*nervia, nervis extus ramosis et transversim crasse venosis*; petiolo *longiusculo, pubere*: racemi *paniculati, axillares, sæpissime longissimi, tomentosi;* flores *minuti, pilosi.*

The following is a list of the species already given in my 'Contributions to Botany,' where the characters are given at full length:—

§ 1. Abuta vera: *folia crasso-coriacea, subtus valde tomentosa, nervis extus ramosis, grossis, valde prominentibus; stamina in ♂ glabra; plantæ scandentes.*

1. *Abuta racemosa,* Aublet (non aliorum).—Guiana; Cayenne (Aublet).
2. —— *barbata,* nob.;—Abuta rufescens, *Tr. & Pl.* (*non Aubl.*).—Cayenne (Sagot, 919).
3. —— *Candollei,* Tr. & Pl.;—Abuta rufescens, *DC.* (*non Aubl.*).—Guiana (Sagot, 1264).
4. —— *heterophylla,* nob.;—Cissampelos convexa, *Vell. Fl. Flum.* x. tab. 142;—C. tomentosa, *Vell. l. c. tab.* 143;—Cocculus tomentosus, *Mart.* (*non Coleb.*);—C. Martii, *St. Hil. & Tul.*;—Rio de Janeiro.
5. —— *macrophylla,* nob.;—Cocculus macrophyllus, *St. Hil. & Tul.*;—Cissampelos Abutua, *Vell. l. c. tab.* 140.—Rio de Janeiro.
6. —— *oblonga,* nob.;—Cayenne (Martin, ♂ & ♀; Le Blond, ♀).
7. —— *cuspidata,* nob.;—Abuta rufescens, *Benth.* (*non Aubl.*).—Barra (Spruce).
   Var. *ovalifolia,* nob.;—Abuta Grisebachii, *Tr. & Pl.*—San Gabriel (Spruce, 2340).
8. —— *rigida,* nob.—Barra (Spruce).

Species illatæ, mihi omnino ignotæ.

9. —— *oblongifolia*;—Cocculus oblongifolius, *Mart.* (*non DC.*).—Rio de Janeiro.
10. —— *Imene*;—Cocculus Imene, *Mart.*—Hyapura.

§ 2. Batschia: *folia minus coriacea, subglabra, nervis minus crassis et prominentibus; stamina in ♂ pilosa; arbusculæ erectæ?*

11. —— *racemosa,* Tr. & Pl.;—Batschia racemosa, *Thunb.*;—Trichoa racemosa, *Pers.*—Rio Magdalena (Triana).
12. —— *Seemanni,* Tr. & Pl.;—Abuta spicata, *Tr. & Pl.*;—Batschia spicata, *Thunb.*;—Batschia conferta, *nob. olim*;—

Trichoa spicata, *Pers.*;—Tricho aconferta, *DC.*—Rio Magdalena et Isth. Darien (Seemann).

13. —— *acutifolia*, nob.;—Abuta concolor, *Benth. in part.*—Panurè (Spruce, 2763).

The *Abuta amara* of Aublet is a species of *Aristolochia.*

The *Abuta candicans*, Rich., seems to accord better with *Chondodendron.*

The *Abuta tomentosa*, Sag., is also probably a *Chondodendron.*

17. Anelasma.

When I proposed this genus, in 1851, for a Brazilian plant, upon a knowledge of the male flower only, its proper position was mistaken, in the absence of the female flower and seed. The examination of a specimen, in fruit, from the West Indies, closely allied to the *Cocculus Domingensis*, DC., figured in Delessert's 'Icones,' led me to infer, from their general appearance, that all these plants belonged to the same genus; but having obtained very soon afterwards other and more complete specimens, I discovered the true carpological structure of *Anelasma*, and found that the *Cocculus Domingensis* and its allied species appertained to *Hyperbæna*—a genus then placed by me in the dubious section for want of a knowledge of its seminal organization. Dr. Grisebach subsequently pointed out the error as regarded *Hyperbæna*, but this I had discovered and rectified long previously. Some species of *Anelasma* and *Hyperbæna* so much resemble one another in the form and veinless texture of their leaves, as well as in their inflorescence, that they might easily be confounded by a superficial observation; but more careful examination and an inspection of their floral or carpological structure will remove all doubt, as the differences in these respects are now well established. The liability of falling into error in the determination of such plants, by trusting to mere external characters, has misled so experienced a botanist as Mr. Bentham, who, in his "Notes on *Menispermaceæ*" (Journ. Proc. Linn. Soc. v. Suppl. 49), not only refers all my species of *Anelasma* to *Abuta*, but has made other misconceptions, which I have pointed out. I need not repeat what has already been said (*ante*, p. 255) concerning the opinions of Dr. Grisebach, Mr. Bentham, and Dr. Hooker in regard to the supposed identity of *Anelasma* with *Abuta*, nor recapitulate my reasons for holding them to be distinct. In addition to the many opposite characters there mentioned, another notable difference is worthy of attention: my own observations demonstrate that the species of *Abuta* proper are very lofty climbers, as may be judged from specimens seen in herbaria, while the remarks of others show that those of *Ane-*

lasma form branching erect trees. Gardner says of the typical plant that it is "a small tree;" and all the other specimens of the genus that I have seen bear the aspect of an erect habit. In every instance seen by me the leaves are perfectly glabrous, and by their nervation and general aspect resemble those of *Cinnamomum*; they never approach an orbicular, and rarely an oval form, but are usually long and narrow, very thick and coriaceous, both sides being subpolished, owing to the immersion of the nerves and more especially of the veins; they present a peculiar appearance from the manner in which their long and strong petioles (much thickened at their apex and articulated at the base) are inserted at an oblique angle on the plane of the leaf. The male inflorescence consists of several extremely slender branching panicles, fasciculated and issuing from a point above the insertion of the petioles, the rachis and its short branches being almost capillary, black, and glabrous: these branches are also charged, at regular intervals, with 3–4 fasciculated ramifications, that again bear several pedicellated minute flowers, which are glabrous and black when dried. This is very different from *Abuta*. The male inflorescence is shorter, seldom exceeding the length of the petiole, and consists of one or two simple racemes, with a single flower upon each lengthened and spreading pedicel, bracteated at its origin, all quite glabrous.

Anelasma, nob.—*Flores* dioici. *Masc. Sepala* 6 vel 9, in ordine ternario alterna, oblonga, carnosa, glabra, 3 interiora majora, obovata, concava, intus striis 2 notata, æstivatione subimbricata. *Petala* nulla. *Stamina* 6, sepalis opposita, subseriata, erecta, conniventia, 3 interiora paulo longiora et latiora: *filamenta* carnosa, subincurva, sursum incrassata; *antheræ* subglobosæ, apicales, filamento subintrorsum semi-immersæ, rima transversali obliqua 2-valvatim hiantes, sæpius septo valvis parallelo et rarius e septulo cruciformi, 3–4-locellatæ.—*Fœm. Sepala* marium. *Stamina* sterilia 6, brevia, circa gynæcium hypogyna, compressa, carnosa, apice 2-glandulosa. *Ovaria* 3, libera, gibboso-globosa, gynæcio brevi centrali insita, glabra, lucida, carnosa, 1-locularia, 1-ovulata: *stylus* brevissimus; *stigma* acute et breviter bifidum aut obsoletum. *Drupæ* 3, vel abortu 2–1, siccæ, oblongæ, subgibbæ, glaberrimæ, subnitidæ, imo excentrice stipitatæ, styli vestigio a basi haud distante notatæ; *putamen* et *semen* iis *Abutæ* conformia.

Frutices vel arbusculæ *Americæ intertropicæ, erectæ, ramosæ*; ramuli *substricti, glabri*; folia *alterna, oblonga, crasso-coriacea, utrinque glaberrima, nitida, 3–5-nervia* (*haud penninervia*), *nervis venisque transversis sæpius immersis, hinc interdum fere evenia*; petiolo *summo basique valde tumido*: paniculæ ♂ *race-*

mosæ, plurimæ (3–5), *fasciculatæ, supra-axillares, graciles, glabræ;* flores *numerosi, minuti, glabri*: racemi ♀ 1–2, *simplices, pauciflori.*

The following is a list of the species, the full characters of which are printed for my 'Contributions to Botany':—

1. *Anelasma Gardnerianum,* nob.;—Abuta concolor, *Benth. in part.*—Goyaz (Gardner, 3567).
2. —— *concolor,* nob.;—Abuta concolor, *Benth.*;—Trichoa concolor, *Endl.*;—Cocculus lævigatus, *Mart.*—San Gabriel (Spruce, 2192); Barra do Rio Negro (Spruce, sub *Cocculus lævigatus,* Mart.).
3. —— *Martianum,* nob.;—Abuta concolor, *Benth. in part.*—Guiana (Martin).
4. —— *Guianense,* nob.;—Abuta concolor, *Benth. in part.*—Guiana (Schomb. 440).
5. —— *Sellowianum,* nob.;—Abuta, sp., *Benth.*—Brasilia (Sellow).
6. —— *Spruceanum,* nob.—Abuta concolor, *Benth. in part.*
7. —— *pallidum,* nob.;—Anelasma laurifolium, *Sagot, MSS.* (*non nob.*);—Abuta concolor, *Benth. in part.*—Barra do Rio Negro (Spruce, 1829); Guiana (Sagot, 20).
8. —— *strumosum,* nob.;—Abuta, sp., *Benth.*—San Gabriel (Spruce, 2393).
9. —— *intaminatum,* nob.—Brasilia (Bowie & Cunningham).

The following species, though unknown to me, appear to belong to this genus:—

10. —— *urophyllum*;—Cocculus urophyllus, *Mart.*
11. —— *laurifolium*;—Cissampelos laurifolia, *Poir.*—Ins. S. Thomæ.

[To be continued.]

XXXI.—*Descriptions of Genera and Species of* Hispidæ. By J. S. Baly.

Having been disappointed, like many others, in the hope that the Trustees of the British Museum would resume the publication of their catalogues, and thereby enable me to complete my monograph of Hispidæ under their auspices, and having during a long period of waiting exhausted both my own patience and that of those numerous friends who have allowed their collections to remain for so long a time in my hands, I have at length determined to publish, from time to time, as opportunities occur, all the materials within my reach in a detached form. I hope

to draw up at some future period, either in the Rev. H. Clark's proposed catalogue or elsewhere, a synopsis of the genera, and thus complete, although imperfectly, the monographic arrangement of this interesting group.

Genus Hispoleptis.

Corpus elongatum, parallelum, modice convexum, dorso subdepressum. *Caput* porrectum, *facie* brevi transversa, inter antennarum insertionem crebre elevata instructum; *antennis* modice robustis, corporis dimidio æqualibus, filiformibus, ad apicem attenuatis, articulis cylindricis, 1^{mo} subgloboso, paullo incrassato, 2^{do} sat brevi, vix incrassato, 3^{tio} elongato, 4^{to} illo fere dimidio breviore, cæteris ad 9^{num} longitudine perparum decrescentibus, $10–11^{mo}$ fere æqualibus, utroque 9^{no} paullo longiore; *mento* subhastato; *oculis* vix prominulis, elongatis, postice leviter sinuatis. *Thorax* elongatulus, apice truncato, basi utrinque sinuata, lateribus fere rectis, a basi ad apicem angustatus, angulis anticis vix productis, acutis, dorso transversim convexo. *Scutellum* latum, pentagonum. *Elytra* thorace vix latiora, lateribus parallelis, muticis, apice conjunctim rotundata, serrata; supra modice convexa, dorso subdeplanata, punctato-striata. *Pedes* validi, mediocres, simplices, *tarsorum* anticorum articulo basali sequentibus latiore; *unguiculis* distantibus.

Type, *Hispoleptis* (*Promecotheca*) *diluta*, Guér. Amazons, Cayenne.

Genus Acanthodes.

Corpus elongatum aut subelongatum, dorso depressum, postice paullo dilatatum. *Caput* porrectum, inter oculos productum; *antennis* rigidis, apice acutis, articulis duobus basalibus brevibus, fere æqualibus, vix incrassatis, 3^{tio}–11^{mum} plerumque inter se coalescentibus, articulationibus sæpe obsoletis, 3^{tio}–6^{num} rarius distinctis moniliformibus; *mento* elongato. *Thorax* basi transversus, medio depressus, ad apicem angustatus, subcylindricus, margine basali utrinque profunde excavato. *Scutellum* transversum, apice obtusum. *Elytra* thorace latiora, subparallela, apicem versus paullo ampliata, apice truncata, angulo postico spina valida acuta armato; dorso costata, interspatiis profunde bifariam punctatis. *Pedes* validi; *unguiculis* contiguis.

Type, *Acanthodes generosa*. Amazons.

This singular genus is remarkable for the small number of joints in its antennæ. It ought to stand near *Odontota*: in some species no less than nine joints coalesce.

1. Antennæ with all their joints, from the third inclusive, coalescent; the sutural lines between them almost or entirely obsolete.

Acanthodes generosa, n. sp.

A. elongata, subdepressa, rufa, oculis antennisque nigris; elytris costatis, utroque sutura antice, margine exteriore macula infra

basin, fascia obliqua prope medium, extrorsum abbreviata, apiceque nigris; ore tarsisque piceis.
Long. $4\frac{1}{2}$ lin.

Hab. Ega, Upper Amazons. Collected by Mr. Bates, to whom I am indebted for a specimen.

Elongate, subdepressed, shining red; antennæ and eyes black; elytra costate, the anterior two-thirds of the suture, the outer border, a square spot in front, an oblique band across the middle, abbreviated at the outer margin, and the apex black. Head subrugose, forehead deeply impressed with a longitudinal fossa; antennæ rigid, very acute, shining black, inner surface of basal joints rufous. Thorax one-half broader than long at the base; sides slightly rounded behind, narrowed and sinuate in front; above cylindrical, depressed and excavated at the middle of the base; surface coarsely and deeply punctured, punctures crowded on the sides; the medial line with a deep longitudinal groove. Scutellum smooth, shining. Elytra deeply punctate-striate, much broader than the thorax, subelongate; sides nearly parallel, scarcely broader behind, narrowly margined, margin slightly dilated towards the posterior angles, its outer edge coarsely and distantly serrate, posterior angles armed with a stout acute spine, which runs almost directly backwards; apex obtuse, its outer edge serrate; above subdepressed along the suture; each elytron with three elevated costæ, which occupy the alternate interspaces between the rows of punctures. Beneath shining rufous; mouth and tarsi piceous.

Acanthodes Hebe, n. sp.

A. elongata, dorso depressa, fulva, nitida; capite, thoracis vitta utrinque, tibiis apice, tarsis elytrisque nigris, his angulo postico spina valida acuta lateraliter oblique producta armatis, utroque tricostato, interspatiis bifariam punctatis, vitta lata discoidali a basi fere ad medium producta, apice extus paullo dilatata, fasciaque lata transversa, extrorsum abbreviata, pone medium posita, fulvis.
Long. $3\frac{3}{4}$ lin.

Hab. Paramaribo, Surinam.

Very similar in form to *A. generosa*; the spines, however, at the hinder angles of the elytra are produced more directly outwards than in that insect; the thorax is also somewhat narrower and more cylindrical; vertex impressed with a longitudinal groove; all the joints of the antennæ from the third upwards intimately connected, without the slightest trace of articulations, their apex very acute. Thorax one-half broader than long, sides straight and parallel at the base, rounded and narrowed in

the middle, sinuate just behind the anterior angles; disk smooth, impunctate, sides rugose-punctate. Elytra subparallel, slightly increasing in width towards the hinder angles; posterior spine keeled above. Four anterior tibiæ armed just before their apex within with a short tooth.

I am indebted for a specimen of this beautiful species to the liberality of Herr Dohrn, of Stettin.

2. Third to sixth joints (inclusive) of antennæ intimately connected; their sutural lines distinct.

Acanthodes nigripennis, n. sp.

A. elongata, dorso subdepressa, rufa, nitida; capite, thoracis vitta utrinque elytrisque nigris.
Long. 4 lin.

Hab. Cayenne.

Elongate, shining red; head, a short vitta on either side of the thorax, its extreme apical margin, together with the elytra shining black. Head slightly excavated on the forehead; vertex shining, impunctate; antennæ with the articulations between the third and the three following joints visible under a lens. Thorax nearly one-third broader at the base than long; sides rounded, narrowed in front, above subcylindrical, deeply excavated transversely near the base; surface impressed here and there with deep distinct punctures, a black stripe on either side closely punctured, subrugose. Scutellum impunctate, shining red. Elytra much broader than the thorax, sides parallel, their outer edge armed with fine, distinct serratures, posterior angles produced directly backwards into a stout acute spine; above subconvex, slightly flattened along the suture; each elytron with three elevated costæ, the outer one less raised than the others, interstices impressed with a double row of deep regular punctures, the third interstice from the suture irregularly punctured along the posterior two-thirds of its course. Beneath shining rufous; apex of abdomen piceous.

Unique in my own collection.

3. Third to sixth joints of antennæ distinctly separate.

Acanthodes tarsata, n. sp.

A. elongata, dorso depressa, postice paullo ampliata, obscure nigro-æenea, nitida; pedibus fulvis, tarsis antennisque nigris, his apice acutis, articulis 2do ad 6tum distinctis, transversis, moniliformibus; thorace conico, profunde punctato; elytris angulo postico in spinam latam acutam, dorso concavam, lateraliter oblique productis; utroque tricostato, interspatiis profunde bifariam punctatis, inter-

spatio tertio pone medium confuse trifariam punctato; femoribus subtus unispinosis.

Long. 3 lin.

Hab. Brazil.

Vertex impressed with a deep longitudinal groove. Thorax conical, the sides being obliquely narrowed from base to apex; on either side, just above the base, is a small, obscure rufous spot. Spine of the elytra broad, deeply excavated above, produced obliquely outwards and somewhat backwards. Abdomen very obscure nigro-æneous, apical segment stained on either side with an obscure rufous patch.

In my collection.

Acanthodes lateralis, n. sp.

A. subelongata, subdepressa, nigra, subnitida, thoracis vitta utrinque elytrorumque vitta laterali, postice abbreviata, fulvis.

Long. $2\frac{3}{4}$ lin.

Hab. Peru.

Subelongate, subdepressed, black; a broad vitta on either side of the thorax, and a broad marginal stripe on each elytron, commencing at the base and terminating below the middle, fulvous. Vertex rugose, deeply grooved down the middle; antennæ acute, shining blue-black, the six basal joints distinct, moniliform. Thorax one-third broader at the base than long, narrowed from base to apex, sides indistinctly sinuate, anterior angles armed with a small obtuse tooth; above subcylindrical, coarsely and deeply punctured, centre of the base slightly excavated. Scutellum shining black. Elytra much broader than the thorax, slightly increasing in width towards their apex, the latter obtusely truncate; sides narrowly margined, the outer edge coarsely serrate, apical margin also serrate; posterior angles produced into a large flattened acute spine, its apex directed obliquely backwards; above subdepressed along the suture; each elytron with three raised costæ, the suture also elevated; interstices with a double row of deep regular punctures, third interstice from the suture with three rows, less regularly placed. Beneath black, sternum fulvous.

In my own cabinet and that of the Rev. H. Clark.

Genus Stethispa.

Corpus elongatum, dorso depressum, nitidum, non metallicum. *Caput* porrectum, *fronte* inter oculos vix producta; *antennis* validis, subfusiformibus, articulis cylindricis, 1^{mo} brevi, vix incrassato, $2–4^{tum}$ singulis primo vix longioribus, 5^{to} ad apicem singulis adhuc paullo longioribus, inter se æqualibus; *mento* elongato, lateribus sinuatis; *oculis* integris. *Thorax* basi transversus, lateribus marginatis, basi

fere rectis, medio rotundato- vel oblique angustatis, ante apicem sinuatis. *Scutellum* transversum, apice obtusum. *Elytra* thorace latiora, lateribus parallelis, prope angulum posticum vix ampliatas, apice rotundata, angulo postico in spinam vel laminam compressam producto, dorso depressa; humeris in spinam validam lateraliter extensis; uterque 4-costatum, interspatiis profunde bifariam punctatis. *Pedes* validi, simplices; *unguiculis* approximatis.

Type, *Stethispa Bonvouloirii*. Amazons.

The produced humeral angles of this genus will at once separate it from its allies.

Stethispa Bonvouloirii, n. sp.

S. elongata, subdepressa, fulva, subnitida; antennis nigris: elytris apice oblique rotundatis, serratis, angulo postico in laminam compressam trigonam, apice acutam, postice concavam, lateraliter vix dilatatam, productis, humeris in spinam validam obliquam, apice truncatam, lateraliter extensis; utroque spina humerali, vitta lata obliqua submarginali ab humero ad longe pone medium extensa, apice dilatata, angulo postico fasciaque subapicali purpureo-æneis.
Long. 4–4½ lin.

Hab. Amazons; Peru.

Epistome produced at the base into a flattened ridge, armed (in the ♂) with two short teeth; front produced, just above the insertion of the antennæ, into a longitudinal ridge. Thorax nearly twice as broad as long, sides nearly straight and parallel at their base, rounded and slightly narrowed in the middle, narrowed and sinuate in front; anterior angles armed with an obtuse, the hinder with an acute, tooth; disk convex in front, flattened behind the middle, surface impressed with large deep punctures, which, crowded at the base, become subremote on the sides, and still more distant on the anterior half of the disk; lateral border bounded within by a single row of deep punctures; medial line impressed with a longitudinal groove, which extends from just behind the apical nearly to the basal margin.

Owing to the indefatigable industry of Mr. Bates, this insect is now to be found in most of our collections.

Stethispa gratiosa, n. sp.

S. elongata, subdepressa, fulva, subnitida, collo utrinque vitta laterali antennarumque dimidio basali nigris; thorace lateribus medio angulatis, obtuse dentatis, utrinque vitta laterali obscure nigro-purpurea, disci medio linea longitudinali antice abbreviata rufo-purpurea: elytris apice obtuse rotundatis, serratis, angulo postico in spinam acutam, retrorsum vix curvatam, dorso concavam, lateraliter valde productis, humeris in spinam acutam recte lateraliter extensis; utroque sutura ante medium, spina humerali, vitta lata submarginali ab humero ad longe pone medium extensa, intus

ante apicem emarginata, apice paullo dilatata, angulo postico fasciaque subapicali inter angulos extensa viridi-æneis.

Fœm. Antennis totis nigris, spinis minus productis, elytrorum vitta submarginali ante apicem interrupta.

Long. $3\frac{1}{2}$ lin.

Hab. Amazons.

Epistome transversely elevated at the base. Thorax not twice as broad as long, sides nearly straight and parallel from their base to the middle, thence obliquely narrowed and sinuate to the apex; lateral border obsoletely crenulate, produced in the middle into an indistinct tooth, anterior angles armed with an obtuse tooth, the hinder angles unarmed; upper surface transversely convex, flattened and transversely excavated behind the middle, deeply punctate; middle of disk closely variolose; medial line with an indistinct longitudinal groove.

Stethispa confusa, n. sp.

S. subelongata, subdepressa, fulva, subnitida, rufo tincta; antennis nigris; thoracis lateribus medio rotundatis: elytris apice rotundatis, vix serratis, angulo postico in spinam dilatatam, acutam, dorso costatam, retrorsum paullo curvatam, valde lateraliter productis, humeris in spinam acutam modice lateraliter extensis; utroque vitta submarginali paullo pone medium, intus dilatata, fasciaque subapicali, rufo-violaceis, spina humerali apice anguloque postico metallico-purpureis; sutura obsolete rufo-fulva.

Long. 3–$3\frac{1}{2}$ lin.

Hab. Obydos, Amazons. Collected by Mr. H. W. Bates.

Very similar in form to *Stethispa gratiosa*; the keeled spine at the hinder angles of the elytra will, however, at once distinguish it from that species. Base of epistome produced into a transverse ridge; an indistinctly raised ridge between the insertion of the antennæ. Thorax somewhat deeply depressed transversely behind the middle; medial line in front impressed with a longitudinal groove; surface deeply but not closely punctured, opaque on the sides and base, shining and still more distantly punctured on the middle of the disk in front: sides nearly straight and parallel behind their middle, thence rounded and narrowed towards the apex; deeply sinuate immediately behind the anterior angles, the latter produced into an acute tooth; lateral border of elytra minutely denticulate.

Stethispa conicicollis, n. sp.

S. elongata, subdepressa, fulva, subnitida, antennarum dimidio basali nigro; thorace subconico, vitta brevi disci medio posita et utrinque linea marginali rufo-fuscis: elytris apice rotundatis, serratis, angulo postico in spinam compressam, dilatatam, acutam, postice serratam, lateraliter sat extensam, retrorsum paullo curvatam,

productis, humeris in spinam acutam lateraliter modice extensis; utroque quadricostato; spina humerali, vitta lata submarginali ab humero ad longe pone medium extensa, apice subdilatata, macula prope angulum posticum fasciaque subapicali inter angulos extensa rufo-purpureis, æneo tinctis, angulo postico metallico-purpureo.

Long. 4 lin.

Hab. Cayenne.

This species may at once be distinguished from the rest of its congeners by the form of the thorax, the sides of which, straight for a very short distance at the base, are thence obliquely narrowed to the apex, being but slightly sinuate behind the apex; its anterior angles produced into an acute tooth; surface depressed and indistinctly excavated transversely behind the middle, rugose-punctate; centre of disk in front nearly impunctate, impressed with the usual longitudinal groove. Base of epistome produced into a transverse ridge. Face furnished, between the insertion of the antennæ, with an acute ridge.

Genus Microrhopala.

Corpus ovatum, modice convexum. *Caput* exsertum, inter oculos vix productum; *epistomate* elevato, rugoso; *antennis* validis, subincrassatis, articulis 5 ultimis clavam elongatam formantibus, 7^{mo} duobus præcedentibus æquali aut longiore, 8^{to}–11^{mum} inter se coalescentibus, lineis suturalibus fere obsoletis; *mento* elongato. *Thorax* subconicus, subcylindricus, dorso depressus. *Scutellum* fere transversum, apice obtuso. *Elytra* thorace latiora, leniter ovalia, apice rotundata, angulo postico obsoleto; dorso modice convexa, profunde punctato-striata. *Pedes* robusti, mediocres, simplices, *tarsorum* anticorum articulo basali parvo, sequentibus angustiore; *unguiculis* contiguis.

Type, *Microrhopala vittata*, Fabr. North America.

Microrhopala is so closely allied to *Odontota* that it is difficult to separate it from that genus; and possibly ultimately it will merge into one of its numerous subdivisions; for the present, the ovate body will serve to separate it.

Microrhopala vittata, Fabr.

H. vittata, Fabr. Syst. Eleuth. ii. p. 64. n. 31; Oliv. Ent. vi. 770. n. 20, pl. 2. fig. 20 *a*, *b*.

M. elongato-ovata, convexa, nigro- aut rufo-fusca; antennis pedibusque nigris; elytris punctato-striatis, interstitiis alternis subcostatis, obscure fusco-æneis, utroque vitta lata fulva.

Long. 3 lin.

" Var. *a*: thorace læte rufo; elytris cyaneis, vitta angustata margine-

que laterali rufis." (Say, in Long's Expedition, ii. Appendix, p. 35.)

Hab. Carolina, Rocky Mountains, New York. In most collections.

I have never seen the variety given by Say in Long's Expedition; he mentions it as occurring plentifully amongst the Rocky Mountains, together with a long chain of intermediate varieties.

Microrhopala Xerene, Newm.

Hispa Xerene, Newm. Ent. Mag. v. p. 390.

M. elongato-ovata, convexa, nigra; thorace fortiter punctato, vittis duabus flavis; elytris profunde punctato-striatis, utroque vitta punctoque subapicali flavis.

Long. 2 lin.

Hab. Georgia; Trenton Falls.

British Museum (type); also in my own collection.

The longitudinal vitta on each elytron occupies nearly the whole of the fourth interstice from the suture, spreading over the row of punctures on either side, and extending from the base to within a short distance of the apex of the elytron; the fulvous spot is placed close to the apex of the third interstice, just below the termination of the fulvous vitta.

Microrhopala excavata, Oliv.

Oliv. Ent. vi. p. 775. n. 29, pl. 2. fig. 29.
Hispa Erebus, Newman, Entom. p. 77. (Type in Mus. Brit.)

M. elongato-ovata, convexa, nigra; thorace profunde punctato; elytris foveis plurimis magnis seriatim dispositis instructis.

Long. 2–2½ lin.

Hab. North America (East Florida). Collected by the late E. Doubleday. In most collections.

Microrhopala perforata, n. sp.

M. elongato-ovata, convexa, nigra, nitida; thorace (macula apicali excepta) elytrorumque maculis quatuor læte rubris.

Long. 2 lin.

Hab. New Granada.

Narrowly ovate, convex, shining black; the thorax (extreme lateral border and an apical patch excepted) and two patches on each elytron bright rufous. Head with the forehead longitudinally strigose; articulations of the four terminal joints of the antennæ indistinctly visible under a lens. Thorax more than one-half broader than long, sides narrowly margined, slightly sinuate behind, narrowed and slightly sinuate in front, above

above subcylindrical, transversely depressed near the base, rugose-punctate. Scutellum shining black. Elytra broader than the thorax, oblong, sides narrowly margined, their outer edge, together with the apical border, finely but distinctly serrate; apex rounded; above convex, each elytron with eight regular rows of large deep punctures, alternate interstices subcostate; an oblique oblong patch before the middle, and a subrotundate spot behind the latter, shining rufous.

A single specimen in my own collection; also in the Rev. H. Clark's cabinet.

Microrhopala pulchella, n. sp.

M. elongato-ovata, convexa, nigra, nitida; thorace elytrisque rubris, his fortiter punctato-striatis, basi fascia lata prope medium maculaque communi apicali cyaneis.

Long. $1\frac{3}{4}$ lin.

Hab. Mexico.

Elongate-ovate, convex, shining black; thorax above and below and the elytra bright rufous; the latter, with their base, a broad transverse band across their middle, together with a large common apical patch, bright metallic blue. Head subrugose on the front; articulations of the four terminal joints of the antennæ visible under a lens, five last joints covered with adpressed fulvous hairs. Thorax more than half as broad again at the base as long, sides rounded, sinuate behind, narrowed in front, above subcylindrical, transversely excavated near the base, rugose-punctate; centre of disk with an indistinct longitudinal groove. Scutellum smooth, impunctate. Elytra broader than the thorax, oblong; sides subparallel, narrowly margined, outer edge, together with the apical border, finely serrate; apex rounded; above convex; each elytron with eight rows of deep regular punctures, the first abbreviated; interstices near the apex, together with the second from the outer border for its whole length, subcostate. Beneath pitchy black; legs black.

Collections of M. Sallé, A. Fry, and my own cabinet.

Microrhopala bivitticollis, n. sp.

M. elongato-ovata, convexa, nigro-chalybea, nitida; thorace utrinque vitta lata rufa; elytris læte chalybeis.

Long. 2 lin.

Hab. —— ?

Elongate-ovate, convex, nitidous; thorax with a broad vitta on either side shining rufous. Head with the vertex rugose; terminal joints of antennæ covered with adpressed fulvous hairs. Thorax nearly twice as broad as long, sides rounded, subsinuate behind, narrowed in front; above subcylindrical,

rugose-punctate, transversely impressed near the base; centre of disk with a longitudinal groove. Elytra broader than the thorax, oblong, sides narrowly margined, their outer edge, together with the apical border, serrate; apex rounded; above convex; each elytron with eight rows of deep regular punctures, interstices obsoletely costate.

A single specimen, without locality, in my own collection.

Microrhopala Salléi, n. sp.

M. anguste ovata nigra; thoracis vittis duabus elytrorumque vitta lata humerali, a basi fere ad medium producta, postice angustata, fulvis; elytris profunde punctato-striatis, interspatiis alternis obsolete vittatis.

Long. 2 lin.

Hab. Guatemala, Mexico.

Thorax transversely excavated at the base, deeply punctured, a longitudinal fulvous stripe on either side, just within the lateral border, continuous with the humeral patch on the elytra; sides of the elytra subparallel, scarcely oval, finely toothed.

In my own cabinet; also sent me for examination by M. Sallé and Rev. H. Clark.

[To be continued.]

XXXII.—*On the remarkable Means by which certain Species of Parasitic Crustacea effect their Conservation.* By M. Eugène Hesse*.

The object of my present paper is to call attention to the means by which the conservation of their species is assured to certain parasitic Crustacea, such as the *Trebiæ*, the *Caligi*, the *Pandoræ*, and the *Chondracanthi*.

All carcinologists are aware that many of these singular animals, which, on their issuing from the egg, are furnished with powerful instruments of locomotion, are, on the contrary, very insufficiently provided with them when in the adult state, some being even completely deprived of them; that, moreover, there are some to which organs of vision have been denied, sometimes in the males, sometimes in the females; so that these disinherited creatures become perforce stationary, and are compelled to follow the fortunes of the fishes at whose expense they live.

In this situation, so perilous to the species, it is easily con-

* Translated by W. S. Dallas, F.L.S., from a separate impression, communicated by the author, of his paper in the 'Mémoires des Savants Étrangers.'

ceivable that, if the prevision which presides over the conservation of all existences did not come to the aid of these degraded Crustaceans, they would speedily disappear, or, at least, that an entire family would perish with the fish which served it at once as a prey and a place of shelter. It is, therefore, of great importance to prevent such a result. I propose to see whether the facts which I have ascertained may justly be regarded as destined to provide against this destruction.

It is not rare to find female *Trebiæ, Caligi, Pandoræ,* and *Chondracanthi* to which young Crustacea of the same species are affixed by a cord, which, although it cannot be called *umbilical,* may be denominated, by analogy, the *frontal cord.* This bond which unites the embryo with its mother does not fulfil functions analogous to those of the umbilical cord in the higher animals, but is destined simply to unite the one to the other. Attached by one of its extremities to the anterior part of the frontal margin of the young Crustacean, it is affixed by the other end to the body of the mother, by means of a circular dilatation in the form of a sucker; and it is sufficiently long and flexible to allow the young Crustacean to act to a certain extent independently of its mother, without disturbing her movements, and to apply itself to the fish upon which they live in common.

It is a spectacle at once surprising and interesting to see these embryos (especially those attached to the *Trebiæ* and *Caligi,* which swim with tolerable rapidity) following the evolutions of their mother like a little boat towed along by a larger vessel, or, again, as a fish attached to a line which keeps it a prisoner, yields to the traction which is thus exerted upon it.

What is the purpose of this curious union? Is it possible to assume it to be the effect of chance, when analogous facts are frequently presented, and have been proved to occur, in several species of these Crustacea? Can it be supposed that it is for the purpose of the alimentation of the embryo by the mother, when the bond of union does not establish any internal relation between them, and they each obtain their own nourishment? I think not; and we must therefore assume that there is some other motive.

If we assume that this young Crustacean is a male, and that the female, seizing a favourable opportunity, passes, carrying it with her, from the fish on which they were living together, to another, we shall at once perceive the consequences of this transmigration, which, uniting in itself all the elements necessary for reproduction, allows this female and the male which accompanies her to found a new colony. This supposition does not appear to me improbable; for, of two things, one must be

true in this case: either chance presides in this union of the young Crustacean to its mother, or it has nothing to do with it.

On the former hypothesis, as the embryo must be either male or female, it is evident that it may sometimes be a male, and then matters would go on as above described; if, on the contrary, it is a female, the conditions of which I have just spoken would certainly no longer exist, but this migration would still have a very useful purpose, since it would transport from one fish to another a young Crustacean, which perhaps might have been unable to perform this migration of itself and by its own powers, and thus contribute to dissemination, which is one of the most essential elements in the conservation of the species; moreover, there is nothing against these females meeting with males in their new position.

The second supposition is the most probable one, in my opinion. Indeed, how can we explain the development of so extraordinary an apparatus at the anterior part of the frontal margin of these young Crustacea without assuming some important motive for the production of this modification? and no reason can well possess more importance than the conservation of the species. Moreover it would be very difficult for creatures so feeble and so destitute of organs of adhesion to maintain their position and resist the action of the waves, which is the more powerful in proportion to the rapidity of progression of the fish on which they occur.

However this may be, I leave these facts as ascertained by me for the appreciation of those who are willing to seek for their solution, which, however, in my opinion, can hardly be other than that indicated by me.

As already stated, the frontal cord is very flexible, especially in its middle part; it is hollow, cylindrical, and covered with a few hairs, and becomes rigid and brittle near the frontal margin; so that it might be broken before the proper time, if another combination had not been made to avoid the possibility of such accidents.

In most of the young Crustacea furnished with this apparatus there exists an articulation below the antennæ and the eyes, which allows this part of the head to bend as if it were borne upon a neck; so that by this means sudden and violent shocks are avoided, as well as the accidents which might be produced by them. A time comes, however, when rupture is necessary,—namely, when the young Crustacean, becoming able to procure its own nourishment, has no longer any need of its mother. It then takes place close to the frontal margin, where here is a sort of umbilicus, which subsequently diminishes and

disappears in such a manner as no longer to present anything abnormal. I cannot say whether this structure is exceptional, from the difficulty of preserving for some time alive such small Crustaceans, which feed only on the blood of fishes, and, consequently, of following exactly all the transformations which they undergo. It is certain, however, that, at the moment of their exclusion from the egg, they do not present this singular appendage, and that it is only at the second or third change of skin that it makes its appearance in those which acquire it. It will be necessary to examine more minutely than I have yet done the bodies and branchiæ of fishes in order to ascertain that the parasites do not attach themselves by this means. I remember, however, having seen some young *Caligi* attached to the branchial laminæ of a fish by a cord of this kind; so that this may be more common than I suppose.

The form of the young Crustacea attached to their mother is perfectly adapted to their situation: it is oval, flat, attenuated at the two extremities, and shaped like a little boat, for the purpose of facilitating natation and offering the least possible resistance to traction.

In this state, the cephalic buckler, which is triangular, presents at each side of the head two antennæ, of greater or less length, composed of two joints, and terminated by some rigid hairs. The eyes are very large, pressed close together, and placed above at the middle of the thorax.

The abdomen is generally divided into five segments, of which the first is the largest; the hindmost is terminated by two processes furnished with very long and stiff hairs, four in number, the two median ones being the longest.

Beneath, near the antennæ, and on each side of the head, are the two first thoracic feet, which are more or less developed and composed of two articulations, terminated by a very strong hooked claw.

The head is oval, rounded at the apex, and pointed at the lower extremity, which is conical, and forms the sucker; below this, according to the more or less advanced stage of development, we may perceive a furrow, which is also seen in the adult *Trebiæ* nd *Caligi*.

Below the first thoracic feet those of the second pair are observed, armed with two crooked claws: these are followed by the third pair, terminated by a single claw.

The abdominal false feet vary according to the species; they generally consist of flat flabelliform joints, fringed with strong hairs, and serving for propulsion.

The ova of *Trebiæ*, *Caligi*, and *Pandoræ* are piled together in the oviferous tubes like pieces of money in a rouleau. Those of

the *Chondracanthi*, on the contrary, are packed together in layers. The eggs never contain more than one vitellus.

The young Crustacea of these various species do not disperse themselves immediately after their escape from the egg; they remain for some time fixed upon the oviferous tubes, from which they afterwards dart in pursuit of their prey, or establish themselves upon the surface of the fish on which they have been hatched.

They swim rapidly and in gyrations, by means of the six biramose feet terminated with long hairs, which they agitate with great force. I have remarked that when an opake body is passed rapidly above the vessels in which they are kept, their movements become much more rapid, which leads me to think that the shadow resulting from the interposition of this body between them and the light produced for them the same effect as that of the passage of a fish within their reach, and which they endeavoured to seize.

In the centre of these young embryos we observe the stomach, which, not being yet filled with food, appears nevertheless to be distended, as if it contained air, and may assist in facilitating progression by sustaining them and performing the office of a swimming-bladder.

The young Crustacea, after their escape from the egg, may exist without nourishment for from three to fifteen days when they are preserved in vessels filled with very pure sea-water and kept in a dark and cool place. There are species which live for a considerable time; but generally the embryos of the *Pandoræ* and *Chondracanthi* die before those of the *Trebiæ* and *Caligi*, which, moreover, are more lively in their movements than those of the former Crustaceans. I have also ascertained that the life of the embryos attached to their mothers by a frontal cord lasted much longer than that of those preserved separately in water, which they survived for a long time, and even until decomposition had set in: this is a curious fact, which seems to me to be evidently in connexion with the prevision which presides over the conservation of species.

Note.—Since writing this memoir, I found, on the 8th of June 1863, on the gills of *Merluccius vulgaris*, a female *Chondracanthus*, to which two *male* individuals, arrived at their perfect development, were attached by a frontal appendage. This evidence seems to me to convert the hypothesis above proposed by me into a certainty, and to confirm my supposition that the males, for the purpose of propagation, attach themselves artificially to the females by the singular means which I have described.

XXXIII.—*On the Fossils of the Hunstanton Red Rock.*

By Harry Seeley, F.G.S., Woodwardian Museum, Cambridge*.

The evidence of a rock's age derived from fossils can never be quite conclusive, and never rank as equal in value with sectional evidence; for the testimony of different species is of unequal importance. And so the opinion formed from a mere glance at the *facies* of a fauna may be of more value than elaborate tables of the range of species. In this way the Red Rock fossils may be said to have an Upper-Greensand character, with some resemblance to Gault; but the same thing would be remarked, only on the latter clause more emphatically, of the Cambridge Greensand.

The fossils in the annexed list are all from Hunstanton, and my own collecting: they are to be seen in the Woodwardian Museum.

The rock is divided into three well-marked layers, nearly equal in thickness. In descending order, they are numbered 1, 2, 3; and in the fifth column of the table a first attempt is made to refer the species to their places in the section.

	Chalk.	Upper Greensand.	Peculiar.	Gault.	Bed
Polyptychodon					
Ichthyosaurus campylodon, *Ctr.*	*	*	..	..	3
Otodus appendiculatus, *Ag.*	*	*	..	..	3
Edaphodus Huxleyi, *Seel.*	..	..	*	..	3
Ischyodus	..	*			
Belemnites attenuatus, *Sow.*	..	..	..	*	all
Belemnites minimus, *Sow.*	..	*	..	*	all
Ammonites splendens, *Sow.*	..	*	..	*	3
Ammonites Studeri, *Pictet*	..	*	..	..	3
Ammonites serratus, *Park.*	..	*	..	*	3
Ammonites Guersantii, *Pictet*	..	*	..	*	3
Ammonites rostratus, *Sow.*	*	*	..	*	2
—— ——, var.	..	..	*		
Ammonites ochetonotus, *Seel.*	..	..	*	..	2
Ammonites solenonotus, *Seel.*	..	..	*	..	2
Ammonites sphærotus, *Seel.*	..	..	*	..	2
Ammonites proboscideus, *Sow.*	..	..	..	*	3
?Crioceras occultus, *Seel.*	..	..	*		
Nautilus simplex, *Sow.*	..	*	..	..	2, 3
Rostellaria Parkinsoni, *Sow.*	*	*	..	*	3
Pleurotomaria					
Emarginula	..	..	*		
Cerithium ornatissimum, *Desh.*	*	*	..	*	3
Plicatula minuta, *Seel.*	..	*	..	..	1
Plicatula sigillina, *Woodw.*	*	*	..	..	all

* Communicated by the author, having been read before the Cambridge Philosophical Society.

	Chalk.	Upper Green-sand.	Peculiar.	Gault.	Bed.
Plicatula inflata, *Sow.*	*	*			
Spondylus latus, *Sow.*	*	*			
Spondylus Dutemplianus, *D'Orb.*	*	*			
Spondylus truncatus, *Goldf.*	*	*			
Ostrea vesiculosa, *Lam.*	*	*			
Ostrea curvirostris, *Nils.*	*				
Ostrea biauriculata, *Lam.*		*			
?Ostrea Normaniana, *D'Orb.*	*	*			
Ostrea hippopodium?, *Nils.*	*	*			
Exogyra conica?, *Sow.*	*	*	..	*	
Exogyra Couloni, *Def.*	..	*			
Exogyra Rauliniana, *D'Orb.*	..	*	..	*	
Exogyra haliotoidea, *Lam.*	..	*			
Exogyra laciniata, *Nils.*	*	*			
Exogyra Rauliniana, var.	..	*			
Pecten Beaveri, *Sow.*	*	*	..	*	
Pecten Cenomanensis, *D'Orb.*	..	*			
Hinnites trilinearis, *Seel.*	..	*			
Hinnites Salteri, *Seel.*	..	..	*		
Neithea quinquecostata, *Sow.*	*	*	..	..	3
Perna sulcata, *Sow.*	..	*	..	*	2, 3
Perna concentrica, *Sow.*	*	*	..	*	
Perna tenuis, *Mant.*	*				
Perna Crispii, *Mant.*	*	*			
Perna					
Perna plana, *Seel.*	..	..	*		
Perna transversa, *Seel.*	..	..	*	..	3
Avicula cuneata, *Seel.*	..	..	*		
Avicula gryphæoides, *Sow.*	*	*	..	..	1
?Trigonia Hunstantonensis, *Seel.*	..	..	*		
Exogyra ungula, *Seel.*	..	..	*		
Exogyra arcula, *Seel.*	..	..	*		
Lima globosa, *Sow.*	*	*	..	..	1
Teredo					
Kingena lima, *Def.*	*	*	..	*	
Crania Parisiensis, *Def.*	*	*	..	..	2
Terebratulina gracilis, *Schl.*	*	*	..	*	1
Terebratulina striata, *Wahl.*	*	*	..	..	3
Terebratula capillata, *Def.*	..	*	..	..	all
Terebratula biplicata, *Broc.*	*	*	..	..	all
Terebratula Dutempliana, *D'Orb.*	..	*	..	..	all
Rhynchonella lineolata, *Phill.*	..	*	..	..	2, 3
Rhynchonella Cuvieri, *D'Orb.*	*	..	..	..	1
Rhynchonella sulcata, *Park.*	..	*	..	..	2
Cardiaster suborbicularis, *Def.*	..	*	..	..	2, 3
Cardiaster, *var.* β	..	..	*		
Cardiaster, *var.* γ	..	..	*		
Koninckocrinus Agassizi, *Seel.*	..	..	*	..	2, 3
Koninckocrinus rugosus	..	..	*		
Pentacrinus Fittoni, *Aust.*	*	*	..	*	
Pentacrinus					
Cidaris vesiculosa, *Goldf.*	..	*	..	..	3

	Chalk.	Upper Green-sand.	Peculiar.	Gault.	Bed.
Cidaris					
Cidaris					
Diadema scriptum, *Seel.*	..	*			
Hyposalenia Wiltshirei, *Seel.*	..	..	*	..	3
Astrogonium					
Sellignota major, *Seel.*..........	..	*	..	..	3
Pollicipes glaber, *Rœmer*.......	*	*	..	..	1
Remains of a Crustacean					
Bernericea polystoma, *Rœm.*	..	..	..	..	2
Bernericea contracta, *Seel.*	..	..	*		
Bernericea Clementina, *D'Orb.* ..	..	..	..	*	
Proboscina dilatata, *D'Orb.*......	..	*			
Cellulipora sulcata, *Seel.*........	..	..	*		
Reptomulticava n. sp.	..	*			
Reptotubigera serpens, *D'Orb.* ..	*				
Vermicularia Phillipsii, *Sow.*					
Serpula antiqua, *Sow.*	*	*	..	*	
Serpula umbonata, *Sow.*	*	*	..	*	
Serpula helix, *Seel.*	..	..	*	..	3
Serpula	..	..	*		
Serpula	..	..	*		
Serpula	..	..	*		
Ventriculites	..	..	..	..	2
Brachiolites labyrinthicus, *Mant.* .	*				
Cephalites					
Siphonia costata, *Lamx.*, var.....	..	*	..	..	2
Chenendopora expansa, *Ben.*, var.	..	*	..	..	2
Scyphia tessellata, *Seel.*	..	*	..	..	2
Scyphia, n. sp.	..	..	*		
Coscinopora quincuncialis	..	..	*		
Spongia paradoxica	..	..	*		

The results of this table may be stated in another.

	Vertebrata.	Encephala.	Lamellibranchs.	Brachiopoda.	Echinodermata,	Polyzoa.	Articulata.	Actinozoa.	Amorphozoa.
Chalk	2	3	18	6	1	1	3	0	1
Upper Greensand .	3	9	25	9	5	2	3	0	3
Gault	0	9	5	3	1	1	2	0	0
Peculiar	1	6	7	0	5	2	1	3	3

Prof. Phillips, talking over this matter of the age of the Hunstanton Rock, remarked that he was far from having perfect faith in the results of the system of counting heads. And

naturally; for if the existence and origin of species should be due to the continuous action of physiological laws, then, seeing that differentiation goes on in a sort of increasing geometrical proportion with every successive elaboration of fundamental organic structures, it will be evident that (supposing groups to be always founded on characters equally important) the duration of the genus or species in time will be directly as its degradation. Consequently species of Vertebrata equal in value with species of Mollusca would mark the age with greater certainty. Hence until characters are coordinated and the relative duration of species worked out, no very determinate conclusion will ensue from the counting of heads.

And there is nothing to show that, because the agencies which accumulated strata in a given area ceased, therefore the life in that area became extinct; for the superposition of a distinct deposit can never *necessitate* a different set of fossils. And as no physical change can operate simultaneously over more than a part of the globe, there must always be a portion of the circumference of the disturbed area where the forms of life will be scarcely if at all affected. And just as, in modern migrations of animals in space, instances occur where some are cut off from the main body and retained in what now seems an unnatural habitat, so must it sometimes in olden times have happened that a smaller or larger body, or all the forms of life of an area, became land-locked, and therefore the species elsewhere characteristic of different deposits would sometimes occur mixed in the same stratum. Hence in cases where fossils hitherto peculiar to any given bed occur in new combinations, their value in fixing the age of the stratum must generally be dubious.

In every class a majority of the fossils was previously known from the Upper Greensand; so it is evident that the fossils indicate a greater affinity with that stratum than with any other. But as there are Gault fossils, and they occur at the base, it is possible that the base of the bed may be older than ordinary Greensand, and bridge over the interval indicated by the change of the Gault to Greensand. Similarly, as there are Chalk fossils, it is possible that the upper part of the bed may be newer than the Greensand elsewhere, and bridge over the gap between that deposit and the Chalk-marl. So the Hunstanton Rock might probably be the most perfect exhibition of the Upper Greensand that is known. Of the named fossils, 58 are Upper Greensand forms, 35 occur in the Chalk, and 21 in the Gault.

But, to see the real value of numbers like those of Gault Cephalopods and Chalk bivalves in the table, it must be seen how

many of the species have hitherto been *peculiar* to the several strata. This is here shown.

	Vertebrata.	Encephala.	Lamellibranchs.	Brachiopods.	Polyzoa.	Echinoderms.	Articulata.	Actinozoa.	Amorphozoa.	Total.
Chalk..........	0	0	2	1	1	0	0	0	1	5
Upper Greensand	1	2	8	4	2	4	0	0	3	24
Gault..........	0	2	0	0	1	0	0	0	0	3
Hunstanton Rock	1	6	7	0	2	5	1	3	3	28

So far as life-evidence can be trusted, this table demonstrates the Hunstanton Rock to be Upper Greensand. With 24 Greensand species, and only 5 Chalk forms, and 3 Gault forms, the affinity of the bed with the latter deposits must be very slight, and need not be anything at all. Hence, and especially as most of them come from the middle of the stratum, the species *peculiar* to the Hunstanton Rock must be regarded as species peculiar to the Upper Greensand.

And when it is remembered how many of the fossils of most Greensand localities had previously only been known from the Chalk or Gault, the proportion here is singularly small. Even in this section there are 14 Greensand species which, since they are also Chalk species, may, at one period of our knowledge, have been peculiar to the Chalk; while there are 3 which, for the same reason, may have appeared to be peculiar to the Gault. Therefore there is *nothing* in the fossils to distinguish this deposit from the Upper Greensand of other localities: to the palæontologist the Hunstanton Red Rock is a northern extension of the Upper Greensand.

XXXIV.—*On the Influence of the Nervous System on the Respiration of Insects.* By E. Baudelot*.

The influence of the nervous system upon the respiration of Insects had attracted but little attention on the part of physiologists until, in 1860, M. Faivre undertook some interesting investigations upon this subject†.

The results of his researches led this naturalist to assume that in the *Dytici*, as in the Mammalia, the respiratory movements have their origin or starting-point in a special region of the

* Translated by W. S. Dallas, F.L.S., from the 'Comptes Rendus,' June 20, 1864, p. 1161.

† Annales des Sciences Naturelles, tome xiii.

nervous system, and that this region in the *Dytici* corresponded with the metathoracic centre or ganglion, the function of which would be to excite the respiratory movements and to coordinate and maintain them. On the other hand, he supposed the movements of the posterior part of the abdomen connected with respiration to be under the influence of the subœsophageal ganglion. The abdominal ganglia, from which the respiratory nerves originate, according to M. Faivre simply play the part of conductors in relation to the respiratory centre or metathoracic ganglion: after the separation of the thoracic centres, they cannot maintain respiration.

Having for some time particularly directed my attention to the comparative physiology of the nervous system, I was struck with the results at which M. Faivre had arrived, and with their complete discordance both with the notions generally entertained regarding the functions of the nervous system in the Articulata and with the previous experiments of M. E. Blanchard upon the nervous system of the Arachnida. I therefore resolved to take up the question; and as with *Dyticus* experimentation is difficult, and the results complex and consequently not very conclusive, I selected as the subject of my investigations a far more favourable insect, namely the larva of *Libellula*.

This larva, as is well known, possesses a nervous chain formed by a series of twelve ganglia, all perfectly distinct from each other. In it the metathoracic ganglion is united with the first abdominal ganglion by long connexions, enabling the two ganglia to be easily separated: in it, also, the respiratory movements are particularly easy of observation, betraying themselves in two different manners—namely, in the first place, by movements of depression and elevation of the inferior half-rings of the abdomen, and, secondly, by the alternate separation and approximation of the five appendages situated at the extremity of the last segment.

The following are the results of my experiments upon this larva. In my first experiment, I cut away the head at noon: respiration was continued with great regularity, twenty-six inspirations per minute being counted; at 6 o'clock P.M. the respiratory movements were still strong and regular; at 9 o'clock the next morning the respiration still persisted, although much weakened, and it was not quite extinct until 3 o'clock P.M. From this experiment we may conclude with certainty that the principle of action of the respiratory movements does not reside in the cerebral lobes: the destruction of the cerebroid ganglia, by suppressing the intervention of the will, appears only to modify slightly the rhythm of the respiration, which becomes less capricious and more regular.

In a second experiment, at 2 o'clock P.M., I made a ligature a little behind the metathorax, and effected the section of the body immediately in front of this. In this way I was quite sure that I had removed the metathoracic ganglion, which is situated at the centre of the space between the insertions of the second and third pairs of legs. At 4 o'clock, however, the number of respirations was eighteen per minute, and the respiration only presented a few irregularities; at 3 o'clock P.M. next day it was still possible to perceive some respiratory movements. To leave no chance of uncertainty, I dissected the portion of the body which I had cut away in front of the ligature: it contained the three thoracic ganglia as well as the first abdominal one.

In a third experiment, the ligature and section were made at the fifth segment of the abdomen, when the respiratory movements, although much weakened and rendered irregular, still persisted for more than twenty-four hours. Nevertheless the portion of the body anterior to the section contained the whole of that part of the nervous chain that extends from the head to the fifth abdominal ganglion.

From these two latter experiments it is quite evident that the metathoracic ganglion is not the prime motory focus of the respiratory movements, since, after the complete removal of this ganglion, respiration continued to be effected for a period of twenty-four hours. With regard to the subœsophageal ganglion, I have been unable to discover in it any special coordinative property; and when the respiratory movements were produced independently of its influence, I always saw the five appendages of the last abdominal segment concurring normally, as before, in the respiratory act with the whole of the other segments of the abdomen.

I repeated these experiments upon the adult *Libellula* with equally conclusive results. The complete section of the body behind the metathoracic ganglion does not cause the suspension of the respiratory movements in the portion posterior to the section, any more than in the larva. Thus in one case, in which I made a ligature and then a section behind the second segment of the abdomen, the respiratory movements persisted for eight hours; the inhalations, which were very regular, rose to fifty per minute, and yet the metathoracic ganglion had been cut away with the anterior portion. In another experiment, the respiration lasted seven hours; it was very regular, and the number of inhalations was sixty-five per minute.

Lastly, in a final experiment, I cut a piece out of the abdomen including only three segments (4–6); and in this I observed very appreciable movements of respiration for some time.

These results and others of precisely similar nature, which I

obtained with larvæ of a Dyticide (probably of the genus *Colymbetes*) appear to me to prove that in insects the respiratory movements are not, as in the Vertebrata, dependent on a special focus of innervation. On the contrary, each abdominal ganglion is a focus of motory innervation, and takes its part in the performance of the respiratory act in its totality. It is also important to remark that, after the section of the nervous chain, the isolated action of a ganglion appears to be weaker in proportion as this ganglion is united with a smaller number of other ganglionic elements.

Thus we see that in this case experiment only confirms what anatomy might lead us to foresee; for when we consider the distribution of the nervous element in the segments of the thorax and abdomen in the Articulata—when we see, in the Crustacea, the respiratory apparatus occupying the most diverse positions, sometimes on the thorax, sometimes on the abdomen, and receiving its nerves from the most different points, it is hardly possible to assume that in insects there is a single focus of innervation for the respiratory function.

XXXV.—*On Museums, their Use and Improvement, and on the Acclimatization of Animals;* being the Address delivered to the Zoological and Botanical Section of the British Association, at the Bath Meeting, by Dr. J. E. Gray, President of the Section.

Before entering upon the special business for which the Section has been called together, viz. the consideration of the Reports to be presented upon various zoological and botanical subjects, and the reading of the papers submitted by the members, I should wish to make a few general observations on some topics which appear to me to have an important bearing on the science which we study, in the hope that they may elicit some observations from the members present. I have always felt that one of the most important uses of the Association was the bringing together of so large a body of men engaged in kindred pursuits, and the consequent promotion of free personal intercourse between those who, not inhabiting the same locality or even the same country, were scarcely likely to meet except on such an occasion as the present. In such meetings the free interchange of thought by means of oral communication is most valuable; for it is in this way that facts are most readily brought into notice, and opinions most freely canvassed, that truth is most effectually elicited, and that erroneous or crude ideas are dissipated, corrected, and improved.

Some of my predecessors in this office have given a summary *résumé* of the recent progress of science in the departments over which I have now the honour to preside, and I had at first thought of attempting to follow their example; but I find myself precluded

from so doing by the conviction that, in order to be of any real utility, such a Report should be of much greater length and fulness of detail than the time at our disposal would fairly admit for the reading, or than the few weeks which have elapsed since I was requested to undertake the office would allow of my preparing. This is, however, the less to be regretted, inasmuch as, in the course of each year, a body of laborious and talented German professors are in the habit of preparing a very full and complete Report of this nature for the Berlin 'Archives of Natural History,' after a plan similar to that which I myself commenced, more than forty years ago, in Thomson's 'Annals of Philosophy.' I have therefore abandoned all intention of attempting such a review, and proceed at once to speak of subjects having a more general bearing upon the interests of our science.

I should wish to say a few words on the subject of Public Museums. It may be well imagined that, having the whole of my life been intimately connected with the management of what I believe to be at the present day the most important zoological museum in the world, it is a subject that has long and deeply occupied my thoughts; and it will also be readily believed that it is only after serious and prolonged consideration I have come to the conclusion that the plan hitherto pursued in their arrangement has rendered them less useful to science and less interesting to the public at large than they might have been made under a different system. Let us consider the purposes for which such a museum is established.

These are two: 1st, the diffusion of instruction and rational amusement among the mass of the people; and 2nd, to afford the scientific student every possible means of examining and studying the specimens of which the museum consists. Now, it appears to me that, in the desire to combine these two objects, which are essentially distinct, the first object, namely the general instruction of the people, has been to a great extent lost sight of and sacrificed to the second, without any corresponding advantage to the latter, because the system itself has been thoroughly erroneous. The curators of large museums have naturally, and, perhaps, properly, been men more deeply devoted to scientific study than interested in elementary instruction, and they have consequently done what they thought best for the promotion of science by accumulating and exhibiting on the shelves or in the open cases of the museum every specimen which they possess, without considering that by so doing they were overwhelming the general visitor with a mass of unintelligible objects, and at the same time rendering their attentive study by the man of science more difficult and onerous than if they had been brought into a smaller space and in a more available condition.

What the largest class of visitors, the general public, want, is a collection of the more interesting objects so arranged as to afford the greatest possible amount of information in a moderate space, and to be obtained, as it were, at a glance. On the other hand, the scientific student requires to have under his eyes and in his hands the most

complete collection of specimens that can be brought together, and in such a condition as to admit of the most minute examination of their differences, whether of age, or sex, or state, or of whatever kind that can throw light upon all the innumerable questions that are continually arising in the progress of thought and opinion.

In the futile attempt to combine these two purposes in one consecutive arrangement, the modern museum entirely fails in both particulars. It is only to be compared to a large store or a city warehouse, in which every specimen that can be collected is arranged in its proper case and on its proper shelf, so that it may be found when wanted; but the uninformed mind derives little instruction from the contemplation of its stores, while the student of nature requires a far more careful examination of them than is possible under such a system of arrangement, to derive any advantage; the visitor needs to be as well informed with relation to the system on which it is based as the curator himself; and consequently the general visitor perceives little else than a chaos of specimens, of which the bulk of those placed in close proximity are so nearly alike that he can scarcely perceive any difference between them, even supposing them to be placed on a level with the eye, while the greater number of those which are above or below this level are utterly unintelligible.

To such a visitor, the numerous species of rats, or squirrels, or sparrows, or larks that crowd the shelves, from all parts of the world, are but a rat, a squirrel, a sparrow, or a lark; and this is still more especially the case with animals of a less marked and less known type of character. Experience has long since convinced me that such a collection so arranged is a great mistake. The eye both of the general visitor and of the student becomes confused by the number of the specimens, however systematically they may be brought together.

The very extent of the collection renders it difficult even for the student, and much more so for the less scientific visitor, to discover any particular specimen of which he is in quest; and the larger the collection, the greater this difficulty becomes. Add to this the fact that all specimens, but more especially the more beautiful and the more delicate, are speedily deteriorated, and in some cases destroyed for all useful purposes, by exposure to light, and that both the skins and bones of animals are found to be much more susceptible of measurement and comparison in an unstuffed or unmounted state, and it will be at once apparent why almost all scientific zoologists have adopted for their own collections the simpler and more advantageous plan of keeping their specimens in boxes or in drawers, devoted each to a family, a genus, or a section of a genus, as each individual case may require.

Thus preserved and thus arranged, the most perfect and the most useful collection that the student could desire would occupy comparatively a small space, and by no means require large and lofty halls for its reception. As it is desirable that each large

group should be kept in a separate room, and as wall-space is what is chiefly required for the reception of the drawers or boxes, rooms like those of an ordinary dwelling-house would be best fitted for the accommodation of such a collection and of the students by whom it would be consulted—one great advantage of this plan being that students would be uninterrupted by the ignorant curiosity of the ruder class of general visitors, and not liable to interference from scientific rivals.

There are other considerations also which should be taken into account in estimating the advantages of a collection thus preserved and thus arranged. A particular value is attached to such specimens as have been studied and described by zoologists, as affording the certain means of identifying the animals on which their observations were made. Such specimens ought especially to be preserved in such a way as to be least liable to injury from exposure to light, dust, or other extraneous causes of deterioration; and this is best done by keeping them in a state least exposed to these destructive influences, instead of in the open cases of a public and necessarily strongly lighted gallery.

Again, the amount of saving thus effected in the cost of stuffing and mounting is well worthy of serious consideration, especially when we take into account that this stuffing and mounting, however agreeable to the eye, is made at the cost of rendering the specimens thus operated upon less available for scientific use.

All these arguments go to prove that, for the purposes of scientific study, the most complete collection that could possibly be formed would be best kept in cabinets or boxes from which light and dust would be excluded, in rooms especially devoted to the purpose, and not in galleries open to the general public, and that such an arrangement would combine the greatest advantage to the student and the most complete preservation of the specimens with great economy of expense.

This being done, it is easy to devise the plan of a museum which shall be the most interesting and instructive to general visitors, and one from which, however short may be their stay, or however casual their inspection, they can hardly fail to carry away some amount of valuable information.

The larger animals, being of course more generally interesting, and easily seen and recognized, should be exhibited in the preserved state, and in situations where they can be completely isolated. This is necessary also on account of their size, which would not admit of their being grouped in the manner which I propose with reference to the smaller specimens.

The older museums were for the most part made up of a number of the square glass-fronted boxes, each containing one, or sometimes a pair of specimens. This method had some advantages, but many inconveniences—among others, that of occupying too large an amount of room. But I cannot help thinking that when this was given up for the French plan of attaching each specimen to a sepa-

rate stand, and marshalling them like soldiers on the shelves of a large open case, the improvement was not so great as many suppose; and this has become more and more evident since the researches of travellers and collectors have so largely increased the number of known species, and of species frequently separated by characters so minute as not to be detected without careful and close examination.

Having come to the conclusion that a museum for the use of the general public should consist chiefly of the best-known, the most marked, and the most interesting animals, arranged in such a way as to convey the greatest amount of instruction in the shortest and most direct manner, and so exhibited as to be seen without confusion, I am very much disposed to recur to something like the old plan of arranging each species or series of species in a special case, to be placed either on shelves or tables, or in wall-cases, as may be found most appropriate, or as the special purpose for which each case is prepared and exhibited may seem to require.

But instead of each case, as of old, containing only a single specimen, it should embrace a series of specimens, selected and arranged so as to present a special object for study; and thus any visitor, looking at a single case only, and taking the trouble to understand it, would carry away a distinct portion of knowledge, such as in the present state of our arrangements could only be obtained by the examination and comparison of specimens distributed through distant parts of the collection.

Every case should be distinctly labelled with an account of the purpose for which it is prepared and exhibited; and each specimen contained in it should also bear a label indicating why it is there placed.

I may be asked, why should each series of specimens be contained in a separate case? but I think it must be obvious that a series of objects exhibited for a definite purpose should be brought into close proximity, and contained in a well-defined space; and this will best be done by keeping them in a single and separate case. There is also the additional advantage that whenever, in the progress of discovery, it becomes desirable that the facts for the illustration of which the case was prepared should be exhibited in a different manner, this can easily be done by rearranging the individual case without interfering with the general arrangement of the collection. I believe that the more clearly the object is defined and the illustrations kept together, the greater will be the amount of information derived from it by the visitor and the interest he will feel in examining it.

Such cases may be advantageously prepared to show—

The classes of the animal kingdom, by means of one or more typical or characteristic examples of each class.
The orders of each class.
The families of each order.
The genera of each family.
The sections of each genus.

A selection of a specimen of each of the more important or striking species of each genus or section.

The changes of state, sexes, habits, and manners of a well-known or an otherwise interesting species.

The economic uses to which they are applied; and such other particulars as the judgment and talent of the curator would select as best adapted for popular instruction, and of which these are only intended as partial indications.

No one, I think, who has ever had charge of a museum, or has noted the behaviour of the visitors while passing through it, can doubt for a moment that such cases would be infinitely more attractive to the public at large than the crowded shelves of our present museums, in which they speedily become bewildered by the multiplicity, the apparent sameness, and at the same time the infinite variety of the objects presented to their view, and in regard to which the labels on the tops of the cases afford them little assistance, while those on the specimens themselves are almost unintelligible.

When such visitors really take any interest in the exhibition, it will generally be found that they concentrate their attention on individual objects, while others affect to do the same, in order to conceal their total want of interest, of which they somehow feel ashamed, although it originates in no fault of their own.

I think the time is approaching when a great change will be made in the arrangement of Museums of Natural History, and have therefore thrown out these observations as suggestions by which it appears to me that their usefulness may be greatly extended.

In England, as we are well aware, all changes are well considered and slowly adopted. Some forty years ago, the plan of placing every specimen on a separate stand, and arranging them in rank and file in large glass wall-cases, was considered a great step in advance, and it was doubtless an improvement on the preexisting plan, especially at a time when our collections were limited to a small number of species, which were scarcely more than types of our modern families or genera.

The idea had arisen that the English collections were smaller than those on the Continent, and the public called for every specimen to be exhibited. But the result has been that, in consequence of the enormous development of our collections, the attention of the great mass of visitors is distracted by the multitude of specimens, while the minute characters by which naturalists distinguish genera and species are inappreciable to their eyes.

It was not, however, the unenlightened public only who insisted on this unlimited display; there were also some leading scientific men who called for it, on the ground that the curator might be induced to keep specimens out of sight in order to make use of them for the enlargement of his own scientific reputation while the scientific public were debarred the sight of them, and that valuable specimens might thus be kept, as the favourite phrase was, "in the cellars." But any such imputation would be completely nullified by

the plan which I have proposed of placing all the specimens in the scientific collection in boxes or drawers appropriated to them, and rendering them thus at once and readily accessible to students at large.

I may observe that the late Mr. Swainson, who was the first to raise the cry, lived to find that it was far more useful to keep his own extensive collection of bird-skins in drawers, like his butterflies and his shells; and that most scientific zoologists and osteologists are now convinced that the skins of animals unmounted and kept in boxes are far more useful for scientific purposes than stuffed skins or set-up skeletons.

So also, with reference to my proposal for the arrangement of the Museum for the general public, I find that those who are desirous of exhibiting their specimens to the best advantage are generally adopting similar plans.

Thus, when Mr. Gould determined on the exhibition of his magnificent collection of Humming-birds, he at once renounced the rank-and-file system, and arranged them in small glazed cases, each case containing a genus, and each pane or side of the case showing a small series of allied species, or a family group of a single species.

When lately at Liverpool, I observed that the clever curator, Mr. Moore, instead of keeping a single animal on each stand, has commenced grouping the various specimens of the same species of Mammalia together on one and the same stand, as several are grouped in the British Museum, and thus giving far greater interest to the group than the individual specimens would afford.

In the British Museum, as an experiment with the view of testing the feelings of the public and the scientific visitors, the species of Nestor Parrots and of the Birds of Paradise, a family of Gorillas and the Impeyan Pheasants, and sundry of the more interesting single specimens, have been placed in isolated cases; and it may readily be seen that they have proved the most attractive cases in the exhibition.

In the Great Exhibition of 1862, Prof. Hyrtl of Vienna exhibited some framed cases of skeletons like those here recommended: one contained the types of each family of Tortoises, another the principal forms of Saurians, &c. They excited much interest, and were purchased by our College of Surgeons.

In some of the Continental museums also I have observed the same plan adopted to a limited extent.

I now exhibit a case of insects, received from Germany, in which what I have suggested is fully carried out. You will perceive that in one small case are exhibited simultaneously, and visible at a glance, the egg, the larva, the plant on which it feeds, the pupa, and the perfect moth, together with its varieties, and the parasites by which the caterpillar is infested. Such cases, representing the entire life and habits of all the best-known and most interesting of our native insects, would be, as I conceive, far more attractive and instructive to the public at large than the exhibition of any con-

ceivable number of rows of allied or cognate species, having no interest whatever except for the advanced zoological student.

I will only add that I am perfectly satisfied, from observation and experience, and that I believe the opinion is rapidly gaining ground, that the scientific student would find a collection solely devoted to the object of study, and preserved in boxes and drawers, far more useful and available for scientific purposes than the stuffed specimens as at present arranged in galleries of immense extent, and crowded with curious and bewildered spectators; while, on the other hand, the general public would infinitely better understand, and consequently more justly appreciate, a well-chosen and well-exhibited selection of a limited number of specimens, carefully arranged to exhibit special objects of general interest, and to afford a complete series for elementary instruction, than miles of glass cases containing thousands upon thousands of specimens, all exhibited in a uniform manner, and placed like soldiers at a review.

I now turn to a very different subject—one which has always occupied a considerable share of my attention, and on which a few observations may not be out of place on this occasion—viz. the acclimatization of animals. This subject, which has been a favourite one with the more thoughtful student, appears all at once to have become popular; and several associations have been formed for the especial purpose of its promotion, not only in this country, but also on the Continent and in the Australian colonies.

I may observe that the acclimatization of animals, and especially the introduction and cultivation of fish, was among the peculiar objects put forward by the Zoological Society at the time of its foundation, nearly forty years ago—although, as we all know, it has been able to do very little for its promotion.

It would appear, from observations that are occasionally to be met with in the public papers and in other journals, to be a prevalent opinion among the patrons of some of these associations that scientific zoologists are opposed to their views, or, at least, lukewarm on the subject. But I am convinced that they are totally mistaken in such a notion, and that it can only have originated in the expression of a belief, founded on experience, that some of the schemes of the would-be acclimatizers are incapable of being carried out, and would never have been suggested if their promoters had been better acquainted with the habits and manners of the animals on which the experiments are proposed to be made.

The term acclimatization has been employed in several widely different senses:—1st, as indicating the *domestication* of animals now only known in the wild state; 2ndly, to express the *introduction* of the domesticated animals of one country into another; 3rdly, the *cultivation* of fishes, &c., by the restocking of rivers, the colonization of ponds, or the renovating of worn-out oyster- or pearl-fisheries by fresh supplies.

Commencing with the first of these objects, which is by many regarded as the most important, I would observe that some animals

seem to have been created with more or less of an instinctive desire to associate with man, and to become useful to him; but the number of these is very limited, and as it undoubtedly takes a long period to become acquainted with the qualities and habits of these animals, and with the mode in which their services may be rendered available, it would almost appear as if all the animals which are possessed of this quality, and are worth domesticating, had already been brought into use. Indeed all those which are now truly domesticated were in domestication in the earlier historic times. The Turkey, it may be said, was not known until the discovery of America; but I think it has been satisfactorily proved that our domestic Turkey is not descended from the wild Turkey of America, but comes of a race which was domesticated by the Mexicans before the historic period. Again, the number of such animals is necessarily limited; for it is not worth while to go through a long process of domestication with the view of breeding an animal that is not superior in some important particular to those which already exist in domestication. For example, where would be the utility of introducing other Ruminants which do not breed as freely, feed as cheaply, afford as good meat, and bear the climate as well as our present races of domestic cattle?

It has been thought that some of the numerous species of African Antelopes might be domesticated here; but every one who has eaten their flesh describes it as harsh and dry, and without fat; and such being the case (even could the domestication be effected, which I very much doubt), such an animal must have some very valuable peculiarity in its mode of life, and be capable of being produced at a very cheap rate, to enable it to take rank in our markets beside the good beef and mutton with which they are at present supplied; and, even supposing it to be semidomesticated only for the park, it could not for an instant be put in competition with the fine venison which it is thought that it might displace.

I am aware that certain French philosophers have lately taken up a notion that it is desirable to pervert the true purposes of the Horse by cultivating him for food instead of work; and that a society of *Hippophagi* has been instituted with this view. Of course, under present circumstances, the flesh of old and worn-out horses is sold for much less than that of well-fed Ruminants; and the *miserable* classes in some countries are glad to obtain animal food of any kind at so low a rate: but whenever an attempt has been made to fatten horses for food, it has been found that the meat could not be produced at so low a rate as that for which far better beef and mutton could be bought.

There are also some small semidomesticated animals, such as the Porcupine and other *Glires*, which are said to afford good meat; but they have long been driven out of the market by the cheapness and abundance of the prolific Rabbit.

With regard to the larger Ruminants (such as the Giraffe, the Eland and some other foreign Deer, the Llama, and the Alpaca), which have been bred in this country, but never brought into

general use, I cannot consider them as at all acclimatized. They have almost always had the protection of warmed buildings, especially in the winter; and though they may have lived through a certain number of years, they are liable to attacks of diseases dependent upon our climate, and generally die off before their natural term of existence is completed. I can only regard them as partially domesticated, and that only as objects of curiosity and luxury, and as incapable of being turned, in this country at least, to any useful domestic purpose.

With regard to those animals which may be considered as more or less completely under the control of Man, there exists considerable difference in the nature of their domestication.

The more typical among them, or truly domesticated, such as the Oxen, the Sheep, the Horse, the Camel, the Dog, and the Cat, like the Wheat and the Maize among plants, are never found truly wild; and when they are permitted to run wild, as in the case of horses and oxen in South America, they are easily brought back to a state of domestication, especially if caught young. What may be called the semidomesticated or domesticable animals, such as the Buffalo, the Goat, the Pig, the Rabbit, the Reindeer, the Yak, and some other Asiatic cattle, are found both in the tame and the wild state, and often in the same region and in close proximity to each other. The Asiatic Elephant, and a few other animals which can be made tractable under man's direction, never (or very rarely) breed in domestication; and all the individuals of these very useful races are caught wild and brought into subjection by training. The African Elephant is evidently equally amenable to man's control, and was equally domesticated by the Romans; but the negroes do not seem to appreciate the advantages which they might derive from its domestication, and only make use of its tractable disposition to keep it in captivity until such time as its ivory is best fitted for the market, when, also they, can feed upon its flesh.

All our domestic or semi-domestic animals have their proper home in the temperate regions of Europe and Asia. They all, except the Ass, bear great cold better than excessive heat; and even the Ass suffers greatly on the coasts of the tropics. The Sheep, in the warmer regions, require to be driven to the cool mountains during the hot season. In the tropics they lose their wool, and, like the long-haired goats and dogs, change the character of their fur. The inhabitants of the arctic region or subarctic regions of Europe and Asia have partially domesticated the Reindeer.

Either Asiatics have a peculiar aptitude for domesticating animals, or the Ruminants of that part of the world are peculiarly adapted for domestication. In the mountain regions of Tibet and Siberia the Yak has been domesticated, and, like the Reindeer of the arctic regions, it is used as a beast of burthen as well as for milk and food. The steppes of Asia are the home of the Camel and the Dromedary. In the lower and warmer regions of central and southern Asia the Zebu has been completely domesticated; and the natives of India and of the islands of the Malayan archipelago have brought into a

semidomesticated state various species of wild cattle, such as the Gyal, the Gour, and the Banting, and have even obtained some hybrid breeds between some of them and the Zebus, as well as the Buffalo, which they have in common with Africa and the south of Europe. In the park of the Governor-General of India there are large herds of the Black Antelope, the Axis Deer, and the Porcine Deer in a semi-domestic state; and our officers found in the park of the Emperor of China at Pekin more than one species of domesticated native Deer. We have as yet received from Japan only one peculiar species of domestic animal, viz. a Pig with a plaited face (*Sus plicatus*); but it is not unlikely that the Deer called *Cervus Sika* is a domesticated species, like the *Cervus Swinhoii* of Formosa. In Celebes there is a small Buffalo called *Anoa*; and in the same island, as well as in Java and some of the other islands of the Indian Ocean, most of the aboriginal pigs, including the Babirussa, have been more or less completely domesticated. These numerous instances will suffice to show how largely Asiatics have been enabled to draw around them for additions to their domestic or half-domestic races; but a glance at the habits and manners of most of them will suffice to show how little they would be suited to our more northern climate, and how small would be the advantage gained were it possible to introduce them here.

Africa has only sent to Europe the Guinea-fowl, that vagrant from our farm-yards; but it too has some domesticated animals of its own. In the more fertile and well-watered parts of that continent there exist at least five different kinds of domestic cattle:—the Buffalo (*Bos Bubalus*) and humpless cattle, which appear to be of the same species and to be derived from the same source as the Buffalo and domestic Oxen of Europe. The African Zebu (*Bos Dante*) appears to be distinct from the Zebu of India, and is probably an indigenous domestic race; and the long-eared bush-cattle, or Zamous (*Bos brachyceros*), are certainly an aboriginal species peculiar to tropical Africa. Besides these, it has, in the Desert regions, the Camel in common with Asia: this animal is also partially domesticated in the southern parts of Europe.

America had only three or (if we reckon the Dog) at most four domestic animals belonging to the country before it was discovered by Europeans, who have, however, since introduced into it most of those which they themselves previously possessed. The Turkey was only domesticated by the native Mexicans; and it may be observed that in Europe these birds have only been imperfectly naturalized, requiring peculiar care and attention in their early stages to protect them from the effects of an ungenial climate. The Llama and Alpaca were also early domesticated by the native Peruvians; and it would appear as if these animals would not bear transportation to other quarters. All the attempts, at least, which have hitherto been made to introduce them into Europe and Australia have resulted in failure. The Esquimaux inhabiting the more northern regions have a peculiar race of dogs, which are in the highest degree useful to them; but it appears to be of the same original stock with the dogs of Europe, and had probably passed from one continent to the other.

In some parts of this vast continent, the Oxen and the Horse, since their introduction from Europe, have so firmly established themselves in a half-wild state as to be often hunted and killed for their hides alone.

Australia and the islands of the Pacific have no native domestic animals, if we again except the Dog; and Australia alone has any mammals sufficiently large to be hunted for their flesh. There formerly existed in New Zealand a large bird (the Moa) which was eaten by the natives; but it seems to have been exterminated, or nearly so, before the colonization of the islands.

European animals have been largely and advantageously introduced throughout the Pacific Ocean, and in some cases have become wild and even dangerous.

As in Europe, all the domestic animals of these various parts of the world appear to have been brought into their present condition for many ages, inasmuch as they were all found in a domestic state when the several countries were first visited by Europeans.

And an attentive study of the list, and of the peculiarities of the animals composing it, induces me to believe that, in attempting to introduce new domestic animals into some of our colonies, it would be desirable not to confine ourselves to the European breeds, but to ascertain whether some of the domestic races of Asia or Africa might not be better adapted to the climate and other conditions of the colony, although, for reasons to which I have before adverted, it would neither be worth the trouble, nor consistent with good policy, to attempt their introduction here.

There is evidently ample room for such experiments, which might be advantageously made, for instance, in the colonies of the coast of Africa, where our horse, ass, oxen, sheep, and goats, and even dogs have greatly degenerated, where the horse and the ass live only for a brief period, where the flesh of the ox and sheep is described as bad and rare, and the flesh of the goat, which is more common, is said to be tasteless and stringy. The pig alone, of all our domestic animals, seems to bear the change with equanimity; and the produce of the "milch pig" is often sold to passengers of the mail packets and the ships on the stations, as the milk of the cow or even the goat is rarely to be obtained. Unfortunately both the white and the black inhabitants are merely sojourners in the land, and do not seem to possess sufficient energy or inclination to make the experiment themselves.

Secondly, as regards the *introduction* of the domestic races of one country into another, there can be no doubt that this is a much more important object in relation to our Australian colonies, and other settlements planted in waste lands, than it is to the old countries, such as all the European states, and that it has been pursued, as far as they are concerned, with great success. Dr. George Bennett, in the third annual 'Report of the Acclimatization Society of New Holland,' has well observed, "We have lately heard of acclimatization dinners in London and other places, but a dinner in New South Wales of food naturalized in the colony occurs every day, and a finer

display cannot be surpassed in any country." Few countries were so badly supplied by nature with useful animals and plants as the Australian continent; and while we do not receive in Europe a single indigenous product for our tables, either animal or vegetable, from Australia, which in this respect has added nothing to the comforts of civilized man, no country has been more richly supplied with the useful products of other parts of the world; for not only have the natural productions of the temperate regions of Europe been largely introduced, but even the flowers and fruits of tropical and subtropical regions.

There is no doubt that the introduction into Australia of animals long domesticated in Europe is far more easy than that of semi-domesticated animals from countries in a ruder state of society. Perhaps this may explain why the leading animals and plants to which Dr. Bennett refers in this Report, and which, be it observed, have all been introduced by individual enterprise, have succeeded so much better than the later attempts to introduce such animals as the Llama and various ornamental Mammalia and birds. Among other attempts referred to are the blackbirds, thrushes, starlings, and skylarks of Europe: these latter seem to be established in the Botanic Garden, but it is doubtful whether such birds can find their appropriate food except in cultivated gardens or near the towns.

On the other hand, it is to be observed that the introduction into a new country of domestic or semidomestic animals is not always an unmixed advantage. Thus, the domestic pig has been completely naturalized in New Zealand: there its great multiplication has rendered it so mischievous a pest to the sheep-farmer, from its following the ewes and eating the newly dropped lambs, that the flock-masters have been compelled to employ persons to destroy the pigs, paying for their destruction at the rate of so much per tail; many thousands are thus destroyed in a single season. Indeed it has been proved by Dr. Hooker's interesting paper "On the Replacement of Species" that the introduction of a new animal or plant often results in its destroying and taking the place of some previous inhabitant, thus rendering its introduction a matter of doubtful advantage, or at all events a question to be approached with considerable caution.

It is, however, manifest that, on the whole, more useful results are to be obtained from the introduction of races already domesticated into countries to which they have not reached, than from the attempt to acclimatize animals for the most part either unsuited to the climate or capable only of an inferior degree of domestication, or inferior in quality to those which are already in possession of the ground.

Under the *third* head, the *cultivation* of fish, I have very little to observe, although the subject is unquestionably one of great importance. But as yet we have very little practical information upon the question; and I consider that the advocates of the system are only for the present feeling their way, as the experiments have not been pursued for a sufficient length of time to produce any positive or reliable results. To replenish rivers in which the fish which formerly inhabited them have been destroyed, it is necessary closely

to study the habits of the fish, and to imitate as much as possible their natural proclivities.

Thus, for example, it appears to me that, when attempting to introduce young artificially hatched fish into a river, we should place them in the smallest streamlets, where the fish would themselves deposit their ova, and not in the wider parts of the stream, where they are liable to injury from various causes. Again, the notion of fishing the breeding-fish out of a river, collecting their eggs and artificially impregnating them, seems to me an unnatural mode of proceeding, and such as is not practised in the cultivation of any other animal. I cannot see any practical advantage that can possibly be derived from it.

For the replenishing of worn-out fisheries of oysters and pearl-shells, all that seems necessary or advantageous to be done is to place round the bed twigs and various similar substances so arranged as to retain the eggs when deposited, and to protect them by all the means in our power, leaving the beds undisturbed for a sufficient time to allow the new brood to become firmly established in them.

Besides the numerous attempts at home to replenish our rivers and oyster-beds, much has been written and large sums have been expended in trying to introduce salmon into the rivers of Australia; but the many failures show how little those who undertook the task were acquainted with the most common physiological questions connected with the removal of fish, and how small was their knowledge of the habits and peculiarities of the fish which they proposed to remove. What, indeed, could be more absurd than the attempt to introduce salmon into rivers which for a considerable part of the year are reduced to a series of stagnant pools. I think I may venture to predict that, if ever salmon are introduced into Australia, they are much more likely to succeed in the deep and rapid rivers of Tasmania than in the streams of Australia proper. At the same time, when we consider the very limited geographical range of the salmon in Europe, confined as it is to those rivers which have their exit into the North Sea, that the attempt to remove it from one river to another in Europe has always been a failure, and that it is not only necessary that the salmon should have a river similar to that which it inhabits here, but also the same food and other peculiarities, without which apparently it cannot subsist, I must confess that I have no great faith in the success of the introduction of the salmon into Australia. I think, therefore, that it is to be regretted that the Australian Acclimatization Society do not rather make some experiments on the introduction of the gouramy, or some of the other edible fish of countries nearer to and more resembling their own.

With other members of the British Association, I have received a reprint of the Rules of Nomenclature drawn up by Mr. Strickland and others, and printed in the Report of the twelfth Meeting of the Association (1842), accompanied with a request to examine them carefully, and to communicate any suggestions to Sir William Jardine, Bart.

I can only repeat the suggestion I made when the rules were under the consideration of the Committee of the Natural History Section of Manchester, viz. that the rules be not adopted until they have been compared with Linnæus's 'Philosophia Botanica,' Fabricius's 'Philosophia Entomologica,' Illiger's 'Prodromus,' and DeCandolle's 'Théorie Elémentaire,' and that when they are not in conformity with the laws proposed by these authors, which have been accepted by all recognized systematic naturalists, the reasons for the proposed alterations should be given in detail. After some discussion, my suggestion was adopted, and the report was remitted to the Committee to carry it out.

The rules were inserted in the printed Report, through the personal influence of Mr. Strickland, who was then a member of the Council, but they never received the sanction of the British Association.

In the 'American Journal of Science and Art' for March 1864 [reprinted in the 'Annals' for June, 1864.] there are some admirable observations by Dr. Asa Gray on some of these rules, which entirely accord with my own views, and which I recommend to the consideration of the Committee.

In conclusion, I would request you kindly to bear in mind that I have simply thrown these observations together in the hope of eliciting the opinions of my colleagues in the Section.

My only desire is that we may all heartily concur in doing all that is in our power to render this and other institutions conducive to the increase of the knowledge, the happiness, and the comforts of the people.

BIBLIOGRAPHICAL NOTICES.

Transactions of the Tyneside Naturalists' Field-Club. Vol. VI. Part II. 8vo. 1864. Newcastle-on-Tyne.

Though the Naturalists' Field-Club of Tyneside cannot rank as the first established among the many kindred clubs that now exist in Great Britain, it would yet appear to be winning, if it has not already won, the premier place, when estimated by the value of its published Transactions. Other field-clubs may possess a larger number of members, more funds, and even greater popularity; but we know of none that is so carefully carrying out the objects for which it was founded, or whose Transactions contribute more to the progress of natural history than this society of naturalists on the banks of the Tyne.

The work which its founders, some eighteen years ago, carved out for it to accomplish was, first, to promote and foster a general taste for natural-history pursuits, and, secondly, to investigate the natural history of Tyneside and the neighbouring district, the results of which were to be published in the Transactions. How far they have, in the latter case, worked out their plan may be judged of by the fact that the Mammalia, Mollusca, Coleoptera, Lepidoptera, Zoophyta, Marine Algæ, and Permian fossils have all been carefully

catalogued and published, besides other matter enough to fill, with the catalogues, six volumes of Transactions; and that they have accomplished something towards promoting a taste for the study of natural history would appear pretty evident when we find that nearly four-fifths of the matter of the Part of the Transactions just issued have been contributed by authors who were school-boys when the Club was founded. Moreover there are now in preparation, by members of the Club, catalogues of the Birds, Crustacea, Annelida, Echinodermata, Foraminifera, Flowering-Plants and Ferns, and Freshwater Algæ of the two counties (Northumberland and Durham). With these completed, we may look in vain, we fear, for another district in England where so much shall have been done towards the investigation of its natural history.

Nevertheless much will then remain for the Tynesiders to accomplish. The Fish, Reptiles, and Amphibia, several orders of the Insecta, all the Arachnida and Cœlenterata, various groups of the Protozoa, besides all the Carboniferous Fossils, both vegetable and animal, will still be left to catalogue. Even with good lists of the faunas and floras of their district, they will scarcely have done more than have taken a census of the inhabitants of their domain. They will know what they have yet to investigate: this much they will have achieved; but the chief part of their work—the true study of the various creatures enumerated in their catalogues—will only be beginning. For the natural history of any animal or plant, let it be ever so lowly, means something more than a pair of Latinized names and a string of scientific words for a diagnosis. This, at least, is our conception of the matter; and we hope that it is that of the working naturalists of the Tyneside Club, and that they will not rest satisfied in cataloguing their natural treasures, but, like true men, will continue their labours until they have wrought out the *history* of them also.

Part II. of the sixth volume of the Tyneside Transactions includes the President's Address for the present year, a catalogue of Mammalia, and papers and reports on zoology, geology, botany, and meteorology, amounting altogether to about 200 pages. Five plates and several woodcuts illustrate the papers. The most important portion of the Part is the Catalogue of Mammalia by Messrs. Mennell and Perkins. Good local catalogues, even of Mammalia, are still desiderata in English zoology; and these authors deserve the thanks of zoologists generally for so valuable a contribution to their science. As the authors observe, there are few districts in England in which we might expect to find so large a mammalian fauna as in that embraced by these two northern counties; for in it are extensive regions of fells, or moors, almost as wild as nature left them, and very sparsely populated, where we may reasonably suppose that several of the wild animals which have long ago disappeared from other parts of England with the progress of cultivation, will still be found to have their retreats.

Of the 75 species of English Mammalia, Messrs. Mennell & Perkins claim 59 as occurring in Northumberland and Durham. They remark as follows:—"Of the 75 species of Mammalia usually in-

cluded in the English fauna, eight are exclusively met with in a domesticated state, viz. the Horse, Ass, Hog, Dog, domestic Cat, Sheep, Goat, and Fallow Deer; and into most lists, in this category only is the Ox entitled to admission..... Our catalogue contains 59 species, 50 of which are wild. Our northern latitude impoverishes our fauna in Bats, or we might show a still greater comparative richness. That the fauna of our district is naturally rich, and has been well worked out, the following figures will show:—

	Wild Species.	Total Species.
"British fauna	67	75
Shropshire	26	35
Staffordshire	29	37
North Kent (Greenwich Club)....	30	39
Cornwall......................	39	48
Northumberland and Durham	50	59."

In their observations on the species, the authors give some interesting remarks on the Chillingham cattle, the Otter, and the Badger. They differ from Professor Owen in their views on the descent of the first of these animals, claiming for its ancestors the wild cattle that roamed the hills of Northumberland when "the beaver built its dams on our rivers, and the bear and wolf preyed upon the roe-deer in our forests." Prof. Owen's opinion is that the Chillingham cattle, with all our larger domesticated breeds, were introduced, in a tame state, by the Romans. "The Roman cattle, from whence he derives the Chillingham race, are, he says, descendants of the Indian Brahmin cattle (*Bos Indicus*, Linn.), which were procured by the Romans from the Greeks, by the Greeks from the Egyptians, and by these from India, probably through the intervention of the Syrians or Persians." "The Highland Kyloes and the Welsh Runts, he considers, are more probably the descendants of the cattle possessed by the Britons at the time of the Roman invasion, inhabiting as they still do the mountain fastnesses to which the Celtic population retired; and these were, he thinks, the descendants of a wild British race, probably identical with the *Bos longifrons*, whose remains occur in the New Pliocene strata, in the brick-earth deposits, drift-gravels, and bone-caves." Messrs. Mennell & Perkins discuss this question at some length; and we certainly think that they bring forward more and stronger reasons for differing from Professor Owen's views than for agreeing with them.

Respecting the Otter, the authors observe, "Our district at the present day may, we think, very properly be designated the head-quarters of this fine animal. It is abundant in all the rivers and larger streams, and even the smaller burns can often testify to its predatory visits. Increasing population, combined with bitter enmity to this terrible foe of the finny tribe, has almost exterminated the Otter in many parts of the country where it was formerly abundant, and caused it to retire to wilder, more remote, and less frequented districts. In haunts like these, and especially in North Northumberland, the Otter exists in, comparatively speaking, un-

disturbed security; and long may it continue to do so!" After these remarks, follow eight pages on otter-hunting, appended to which are four lines and a half of information on the natural history of the animal. We certainly think that, both here and in other parts of the catalogue, a great deal of matter has been introduced which would have been better kept out. Observations on otter-hunting would be suitable enough for a sporting-journal, such as 'Bell's Life' or the 'Field,' but they scarcely seem appropriate in a scientific catalogue of Mammalia. Again, in noticing the Fox, our authors limit their natural-history observations to saying that it is "abundant in both counties." Then we have a paragraph on the philology of the word "tod," the local term for the fox. Afterwards follows a page of information on the packs of fox-hounds, and their owners and huntsmen of the two counties. We are told, for example, that "the Durham county pack contains fifty-one couples; they hunt four days a week, viz. Monday, Tuesday, Thursday, and Saturday; J. Henderson and J. Harvey, Esqs., are the masters, Mark Carr the huntsman, and Stephen Winkworth the whip. The kennels are at Sedgefield and Farewell Hall;" also that "the Alnwick pack is new,—we believe, also a 'scratch' or 'trencher-fed' pack." How all this comes under the head of *Canis vulpes* we are at a loss to tell. We should have thought that, if it had to be included at all, *Canis familiaris* would have been the most suitable heading; with a little more discretion on the part of the authors and editors, it would have been kept out altogether.

Now that we are criticising—as criticism is usually understood—we may further point out that certain species appear to be included in the list on very slender grounds, and in some cases, indeed, on no grounds at all. Passing over the first on the list, *Homo sapiens*, whose presence there is amusing rather than objectionable, we come to the Wolf (*Canis lupus*), which does not seem to have existed in Northumberland and Durham much later than the third Henry. A little further on we meet with the Roe Deer, Red Deer, and Beaver, all of them animals long extinct. It may be, perhaps, that these species are rightly included in the list; but that depends upon the principle on which the catalogue has been constructed. If the authors have comprehended all the mammals that have existed in the district during the historical era, these species ought, of course, to be included. This would be the principle the geologist would adopt; for he must have an era or period to work in. But the zoologist or investigator of recent life deals with time more sparingly: his investigations, indeed, are almost limited to the present—to life in all its various aspects, as he can now observe it. Hence it would perhaps have been as well to have kept such species as those named apart from those which exist in the district in the present day—in other words, to have made their primary list one of species that compose the existing mammalian fauna of the district, with a supplementary list of such other species as are known to have formerly existed, but which are now extinct; for what we most want to learn from a catalogue of this kind is not so much what the fauna of any part of England was 300, 500, or 1000 years ago, but what it is now, *anno Domini* 1864.

For the same reasons we would object to some of the Cetaceans which appear in the list. The High-finned Cachalot, in fact, has never been captured on the Northumberland and Durham coast at all, and is included merely because it is said to have been seen at sea off the Dogger Bank! Sailors, however, are not always safe authorities for the naturalist to follow; and though they may have seen the Cetacean in question, they are just as likely to have seen something else which they mistook for it.

But the most injudicious or ludicrous (we scarcely know which) insertion is that of the Alpine Hare (*Lepus variabilis*), of which the authors coolly state, "We are not aware that this species has been met with in our district, though we see no reason why it should not occur on the Cheviots and high fells which separate our counties from Cumberland and Westmoreland, the mountains which it inhabits." Now really this is too bad, and indicates such an utter want of carefulness on the part of the authors as to throw suspicion over the whole catalogue. For it is quite evident that, besides the species which they *know* to exist in Durham and Northumberland, they likewise include those which they *think* ought to exist—two very different things. Certainly, if this be the fashion after which the Catalogue of the Northumberland and Durham mammals has been constructed, no wonder that it is the largest local list that has yet appeared in England!

In a paper by Mr. G. S. Brady, on the Zoology of Hylton Dene, we have an account of a careful examination of the faunas of a series of pools of brackish water, of different degrees of saline strength, situated on some marsh-land near to the River Wear, about two miles and a half from its mouth. The pools which are the most saline are solely inhabited by marine species (the common Stickleback excepted), among which are Nudibranchiate Mollusca, Shrimps and other Crustacea, Foraminifera, and Annelides. In pools further removed from the influence of tidal action, and hence containing a smaller percentage of saline matter, some of the above forms are absent; but, as no freshwater species appear, the fauna remains marine. Further away still, is another pool, which the overflow of the highest tides rarely reaches, and which is therefore virtually freshwater. Here are Water-rats, Beetles, Freshwater Mollusca, Entomostraca belonging to *Cypris* and *Cyclops*, and other freshwater animals and plants; and the banks of the pool are fringed with grasses and brushwood. But amidst all these indications of freshwater conditions likewise appear two or three species of Prawns and Shrimps, which, as the author says, "it is strange to see gliding among the leaves of the Callitriche, and overshadowed by the blossoming wild-rose and whin." The author further observes that these marine Crustaceans do not seem to have deteriorated from their residence in fresh water, except in the case of the Prawn, which is rather small.

There are few subjects in natural history that promise more interesting and important results than that which Mr. Brady here takes up. For the zoology of an estuarine or brackish region, whe-

ther small or extensive in area, is the zoology of a sort of border territory, where marine and freshwater life meet and to some extent commingle. It is here that the *conservatism of species* is tested, or where new conditions offer them the best opportunities for showing the strength of their tendencies towards change and advancement—or, perhaps, change and retrogression. If the white bear of Darwin has ever to become a whale, it is under such circumstances that we should expect to see it acquiring those new habits that are to result in such a transformation of its structure, organization, and mode of life.

There are also other grounds on which investigations like the present are of great interest; for they throw light on the researches of the palæontologist, more especially on that still disputed question among geologists, the origin of the coal-measures, whether they were formed in fresh or salt water. We will quote the remarks of the author on this point.

"Estuarine swamps such as this which we have just noticed seem to be the nearest analogues we now possess of those extensive lagoons which, during the Carboniferous period, supported the rank vegetable growths now fossilized in our Coal-measures. To the palæontologist it must be a matter of considerable interest to note the association of species in such localities; and I think enough has been said to show that considerable caution should be used in pronouncing upon the freshwater or saline nature of any deposits merely from the nature of the animal forms which they enclose. Judging from analogy, however (if our own island may be taken as a type), we should suppose that any great luxuriance of vegetable growth must be indicative of freshwater conditions. We uniformly find in the saline portions of these marshes a peculiarly dwarfed and stunted vegetation, while as we recede from the salt-water influence, it often assumes a rank luxuriance, putting on a character quite as much in accordance with the vegetation of the coal-period as can be expected in these degenerate days."

Mr. J. Hancock furnishes a paper on the recent occurrence of Pallas's Sand-grouse in Northumberland and Durham, in which he informs us that about twenty-three individuals of that species were shot in those counties in the year 1863. It is just possible that this Siberian visitor may meet with a suitable habitat in some of the northern parts of our island, and so remain a permanent resident with us, though we doubt much whether this can be, in our present state of high civilization, and with that rampant propensity for exterminating which the modern Englishman exhibits to everything that he cannot domesticate into his burden-bearing or flesh-feeding retainers.

We cannot refer at length to the other papers that appear in the Part, though several of them contain valuable information both to the naturalist and the general reader. Suffice it to say that among them are papers on Coal-miners, by Dr. Wilson; on Ostracoda, by G. S. Brady; on Pycnogonoidea, by G. Hodge; on Coal-measure Fishes, by Messrs. Kirkby and Atthey; and on the Rain-fall, by

G. C. Atkinson; some of which memoirs have already appeared in our pages. There is, moreover, a series of papers composing the Dredging-Report of 1863, containing much important matter. We think, however, that it would be well for the editor of the report to adopt for the future greater uniformity in tabulating the results of the dredgings. Each list, for example, ought to be drawn up after the same plan, with the same system of nomenclature throughout, so far as concerns locality and depth. As it is, very little information at all is given respecting the depth of the different dredgings, or the nature of the ground, both of which are points of great importance in the distribution of species. Regarding the localities where the dredging-operations took place, each author seems to have adopted a nomenclature of his own: thus one set of dredgings is referred to, by the different authors of the report, as having taken place "off Berwick," "off Holy Island," and in "Berwick Bay;" and we suspect that "the Durham coast" and "off Seaham" both refer to the same locality though they appear to refer to different places. All this is very confusing, and may lead to the report being misunderstood. When the next Dredging-Report appears, we should be glad to see the different dredging-papers drawn up after the method of Edward Forbes and M'Andrew, with the locality, depth, nature of ground, distance from shore, quantity of individuals of each species, and whether dead or living, and condition, all clearly stated for every dredging. At the same time we trust that some explanation will be given of the signs used in the lists; for at present who except the authors can have the slightest idea of what is expressed by the letters *c.*, r., r.c., v., &c.?

Notwithstanding these and the preceding strictures which we have deemed it our duty to make in noticing this Part of the Tyneside Transactions, we must say, in conclusion, as we said or implied at the beginning, that there is far more in it to admire than to disapprove.

The Physical Geology and Geography of Great Britain: Six Lectures to Working Men, delivered in the Royal School of Mines in 1863. By Prof. A. C. Ramsay, F.R.S. &c. Second edition, pp. 199. London: E. Stanford. 1864.

The success of this little book has confirmed an impression we have long been under, that one of the most paying works a competent geologist could undertake is a new edition of Conybeare and Phillips's 'Geology of England and Wales.' Students of geology would accept it as a guide, and professed geologists would use it as a text-book, while professors and lecturers would recommend it as both.

These Lectures were not published with any such ambitious design: they were delivered to an audience of working men, at a nominal fee of sixpence for the course, in the Museum of Practical Geology; and the first edition of them was printed last year from the notes of a short-hand writer. Prof. Ramsay remarks, in his

preface to this edition, that the former contained many imperfections and mistakes, but that in this the whole work has been corrected, revised, and in parts almost re-written. This confession has probably been made in deference to the strictures of a few captious critics, who cannot understand, or are unable to tolerate, good honest Anglo-Saxon (a little *too* honest, it may be, at times), perfectly suited to the bricklayers, carpenters, and blacksmiths for whom it was intended. But it appears to us that one of the most valuable (because one of the most rare) gifts which Prof. Ramsay possesses is that of being able, with perfect ease and apparently without effort, to adapt himself so well to the calibre of his audience. He is thus equally at home, though acting so differently, as President of the Geological Society and as a teacher of geology to working men.

The principal addition made to the book in this edition is a little coloured geological map of Great Britain, done wonderfully well, considering the scale, and extremely useful as a help to the unlearned in their attempts to understand the subjects treated of. Professor Ramsay's plan of instruction in this case is to associate the peculiarities of the geological structure of the country with those of its surface-configuration; and thus he is enabled to impress more vividly on the mind the salient features of the one subject, and to explain more easily the causes of the phenomena included in the other. Nothing could be more simple, or better adapted to the audience, than this plan of procedure; and the exhaustion of the first edition of these Lectures in less than a twelvemonth shows that nothing could be more acceptable, or better understood, by the public at large.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Jan. 26, 1864.—E. W. H. Holdsworth, Esq., F.Z.S., in the Chair.

Notes on Seals (Phocidæ), including the Description of a New Seal (Halicyon Richardii) from the West Coast of North America. By Dr. J. E. Gray, F.R.S.

Mr. Charles B. Wood, the Surgeon of H.M.S. 'Hecate,' has very kindly sent to the British Museum, along with other interesting specimens from the north-western part of North America, the skeleton of a Seal from Fraser's River, and the skull of a Seal obtained on the west coast of Vancouver's Island.

The skull was procured from the natives, who had the animal towed along the side of their canoe. They refused to part with the entire animal, but were at length induced to sell the head.

The examination of the skulls shows that the two Seals evidently belong to the same species, the specimen from Fraser's River being adult, and the other not quite so old. Mr. Wood observes that "the younger Seal was captured among the islands in Queen Charlotte's Sound, at the north end of Vancouver; has a fur of a dark brown,

almost black colour; and is unlike that from the Fraser's River, which is lighter and less timid, being often seen seated on a log floating down with the current."

The skull of this Seal differs so greatly from those of any of the Seals on the eastern side of the Arctic Ocean, that I am induced to propose for it a new subdivision, which may be thus named and characterized:—

HALICYON.

The palate of the skull arched out behind. Cutting-teeth $\frac{6}{4}$. Grinders 3 or 5, lobed, compressed. The lower jaw strong, bowed out on the sides, thick in front, and with a low crest on the inner side of the lower edge near the front; the ramus of the lower jaw erect, with a tubercular prominence beneath the notch at the angle.

HALICYON RICHARDII, sp. nov.

Fur pale brown; when young, darker.

Hab. Fraser's River and Vancouver's Island.

I have dedicated this species, at the request of Mr. Wood, to Capt. Richard, the Hydrographer to the Admiralty, and Captain of H.M.S. 'Hecate' when these Seals were collected. I have the more pleasure in doing this, as the Museum has received many very interesting specimens collected during the voyage of the 'Hecate,' showing the interest which her Commander takes in the natural sciences, which I have no doubt will receive additional encouragement in the new position which he has won by his hydrographic and scientific qualifications.

The skull resembles that of *Callocephalus hispidus* and *Pagophilus grœnlandicus* in the dilatation of the front part of the lower edge of the lower jaw; but it agrees with *Callocephalus hispidus* most in the greater development of the face, and in the concave edge of the hinder part of the palate.

It differs from these skulls—

1. In the dilatation of the lower jaw not being extended so far back, only occupying the first two-fifths of the length of the jaw; while in the other two species it occupies full half the length of that bone.

2. In the sides of the lower jaw being much wider apart, and arched outwards, making the space between them much wider behind, agreeing in this respect with *Phoca barbata*.

3. In the front of the lower jaw being thick and swollen, and with only a slight ridge on the middle of the lower edge in front, and the jaws in this part being well separated from each other, not thin, concave inwardly, and with a well-developed inferior edge on the inner sides, those of the two sides of the jaws being parallel and near together in the centre. The angle at the hinder lower edge of the lower jaw is much more produced, and with a more prominent tubercle, than in either *Callocephalus hispidus* or *Pagophilus grœnlandicus*.

4. The hinder edge of the palate being concave forwards, and not straight and transverse as in *Pagophilus*, nor angularly cut out as in *Callocephalus*.

In the younger specimen the edge of the palate has a slight prominence in the middle of each side ; but this is evidently an accidental deformity, as the prominences are not of the same size in the two sides. In the adult skull the two sides of the palate are evenly arched out.

The lower jaw most resembles that of the restricted genus *Phoca* (of which *P. barbata* is the type) in being solid and strong, and in

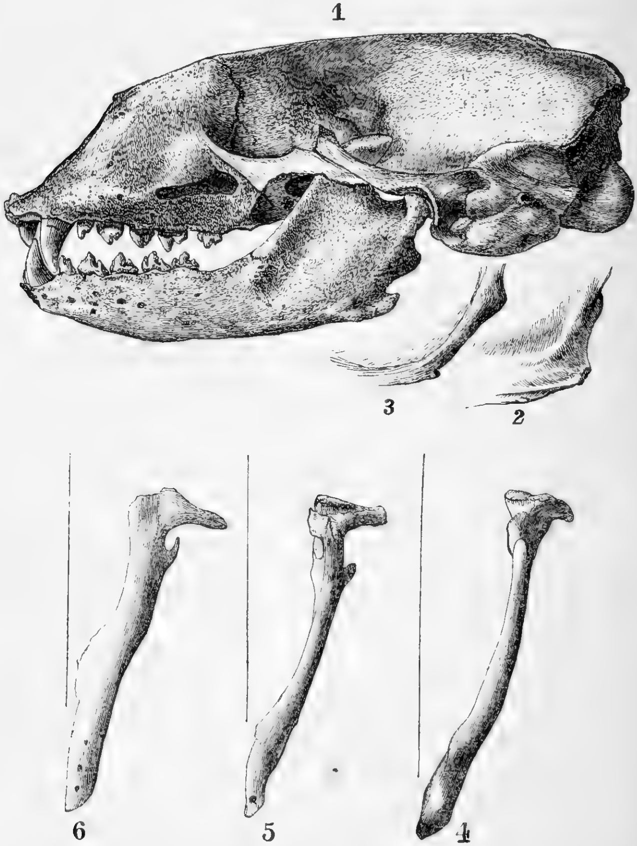

Fig. 1. Skull of *Halicyon Richardii.*
2. End of lower jaw of *Phoca barbata,* to show the dilatations and inflexions of the lobe over the angle.
3. End of the lower jaw of *Pagomys fœtidus.* The end of the jaw of *Callocephalus vitulinus* is somewhat similar.
4. Lower edge of the lower jaw of *Halicyon Richardii.*
5. Lower edge of the lower jaw of *Phoca barbata.*
6. Lower edge of the lower jaw of *Pagophilus grœnlandicus.* The jaw of *Pagomys fœtidus* is somewhat similar, but much smaller.

the two sides being arched out, leaving a very wide oval space between them, the front part of the space being continued by a tubercle on the inner edge of the front of the jaw, a short distance from the symphysis.

In *Phoca* the tubercle on the inner side of the lower edge is short, rounded, blunt, and more or less rugose; in the new Seal, *Halicyon*, it is a short-edged, elongated ridge. In *Phoca* the teeth are small, erect, and far apart; and in *Halicyon* they are larger, closer together, and distinctly three- or five-lobed.

In *Halicyon* the hinder edge of the ramus of the lower jaw is simple, with a distinct notch between it and the tubercular angle of the jaw. In *Phoca* the hinder edge of the ramus is inflected, forming a large half-oblong lobe, convex in front, and concave behind. (fig. 2).

It is very interesting to observe that there is a representative genus on each side of the Arctic Pole; and this agrees with my previous experience—that each species of Seal has a limited, indeed I may say a very well-defined and very limited, geographical distribution. Though the species are very difficult to distinguish by their external characters, yet the skeleton, and especially the skull, affords well-marked and very definite characters.

M. Lepechin described a *Phoca oceanica* (Act. Petrop. 1777, 259. t. 6 & 7), which has been considered the same as *Pagophilus grœnlandicus*, as abundant on the ice around Nova Zembla. It would be curious to see the skull of a specimen from that locality, and thus discover which species extends itself so far north as those islands. *Phoca oceanica*, in its young and old state of fur, resembles *Pagophilus grœnlandicus*; but unfortunately we have only a very limited knowledge of the external appearance of this new Seal from Vancouver's Island.

The study of a large series of specimens of several species of Seals shows that the form of the lower jaw, though hitherto little attended to by zoologists, affords a very good character for the distinction of the species.

In *Pagophilus grœnlandicus* and *Halicyon Richardii* the angle of the lower jaw is far back, and the hinder edge of the ramus ascends nearly perpendicularly, with a notch at the hinder end, as shown in fig. 6. In *Phoca barbata* the form of the lower jaw and ramus is nearly similar; but instead of a notch near the angle, the inner edge is produced inwards into a rounded lobe (fig. 2, and see Cat. Seals B.M. p. 27, f. 9).

In *Callocephalus vitulinus* and *C.* (*Pagomys*) *fœtidus*, on the contrary, the angle of the lower jaw is more towards the front, and the hinder edge of the ramus ascends obliquely with the notch considerably in front of the condyle (see fig. 3).

M. Gaimard, in his 'Voyage to Iceland and Greenland,' Mammalia, plate 11, devotes a plate to the skull and teeth of the Seals of Iceland and Greenland; but he does not pay any attention to the form of the lower jaw, except incidentally, when representing the teeth of the lower jaw of his *P. annellata* (t. 11. f. 9). I may ob-

serve that this author names on his plates what we call *Phoca annellata P. hispida,* and what we call *P. grœnlandica P. annellata.*

Believing it to be desirable that the Seals, which are so difficult to distinguish by their external characters, should be divided into small sections or subgenera by organic characters, I propose to divide the tribe of *Phocina,* as defined in my Monograph (see Cat. Seals in the British Museum, p. 20), thus :—

1. Branches of lower jaw diverging ; the lower edge of the lower jaw rounded, simple ; palate angularly arched behind ; angle of lower jaw blunt, sloping behind. CALLOCEPHALUS. *C. vitulinus.*

2. Branches of lower jaw diverging ; lower edge of lower jaw dilated on the inner side.

   * Palate angularly notched behind ; angle of lower jaw blunt, sloping behind. PAGOMYS. *P. fœtidus. P.? nummularis.*

   ** Palate truncated behind ; angle of lower jaw acute, erect behind, with a notch above the basal tubercle. PAGOPHILUS. *P. grœnlandicus.*

3. Branches of lower jaw arched on the side and wide apart ; lower edge produced on the inner side behind the symphysis ; palate arched.

   * Tubercle on inner edge of front part of lower jaw elongate, sharp-edged ; teeth moderate ; angle of lower jaw simple, with a distinct notch above it. HALICYON. *H. Richardii.*

   ** Tubercle on inner edge of front part of lower jaw blunt, rugulose ; teeth small ; angle of lower jaw with a rounded lobe on inner side above the basal tubercle. PHOCA. *P. barbata.*

PAGOMYS ? NUMMULARIS.

The lower jaws short and broad ; the grinders thick, with a broad thick central lobe, and nearly side by side (in the skulls of the young animals).

Phoca nummularis, Temm., Faun. Jap. Mamm. Mar. p. 3.

Hab. Japan (*Temm.*).

This species is only known from some skins and three fragments of skulls in the Leyden Museum.

My excellent friend Professor Schlegel, the energetic Curator of the Leyden Museum, has most kindly sent to me for examination and comparison the fragments of skulls above referred to : they consist of the face-bone and the lower jaws of three specimens ; the most perfect specimen has part of the orbit and the upper part of the brain-case attached to it. They are all from very young specimens, of nearly the same age ; and, unfortunately, the most perfect one is without the hinder portion of the palate, so that I cannot make sure that it has the same form of the palatine margin that is found in *Pagomys* ; but the part of the side of the palate that is present, when compared with the same part in *Pagomys,* leads one to think it most likely to be of the same form as in that genus.

The general form and size of the face, and the form of the teeth, are very similar to those of a skull of *Pagomys fœtidus* of the same age. It only differs from the latter in the lower jaw being rather shorter and broader, in the grinders being larger, thicker, and rather closer together, in the central lobe of the grinders being considerably larger, thicker, and stronger, and in all the lobes of the grinders being more acute. The lower margin of the lower jaw is dilated in front, just as in *Pagomys fœtidus*; but the jaws behind the dilatation diverge more from each other, leaving a wider space between them at the hinder part. The form of the hinder angle of the jaws is very similar in the two species. The orbit is rather smaller and more circular; for in *P. fœtidus* it is rather oblong, being rather longer than wide. The forehead appears, as far as one can judge by the fragments, to be flatter and broader, and the nose rather shorter.

The following measurements show the difference between the two species:—

	P. fœtidus. in.	12ths.	*P. nummularis.* in.	12ths.
Length of lower jaw to hinder notch ..	2	11	1	7
Length of lower jaw to end of dilatation.	1	$5\frac{1}{2}$	1	$2\frac{1}{2}$
Length of upper teeth-line	1	$3\frac{1}{2}$	1	2
Length of three grinders	0	$2\frac{1}{2}$	0	3
Width at outside of hinder notch......	1	9	1	7
Length of orbit	1	$8\frac{1}{2}$	1	5

The *Phoca nummularis* of Japan has been considered to be identical with *Phoca Largha* of Pallas, from the east shore of Kamschatka, the *Phoca Chorissii* of Lesson, and the *Phoque tigre* of Kraschennenikow (which has been named *Phoca tigrina* by Lesson), on the strength of their coming from nearly the same district; but I am not aware that specimens of any of the latter species exist to verify the union and determine what are the species described under these names.

The British Museum has lately purchased the dead body of a Seal, which had been exhibited in London as the "Talking Fish." The proprietor, an Italian, at first said it was from the coast of South America, but afterwards admitted that it was from one of the ports on the north side of the Mediterranean; and on examination it proved to be the Monk Seal (*Phoca albiventer*), the type of the genus *Monachus* of Fleming and *Pelagus* of F. Cuvier, a genus which was one of the desiderata in the Museum Collection.

The comparison of the skull of this animal with the skulls of the Seal from Madeira, which I described in the 'Annals and Magazine of Natural History' for 1854 under the name of *Heliophoca atlantica*, has shown that the latter animal is the same as the Mediterranean Seal.

The British Museum has since received from M. Verreaux a very good skeleton of a Seal from Algiers, under the name of *Phoca leporina*, which is evidently the same as the *Phoca albiventer* of Cuvier (Oss. Foss. v. t. 17).

The following synonyms will therefore have to be added to those which I have placed under *Monachus albiventer* in the Catalogue of Seals in the British Museum, p. 18 :—

Heliophoca atlantica, Gray, Ann. & Mag. N. H. 1854 ; Arch. f. Nat. 1855, p. 40.

Phoca leporina, Verreaux, not of Lepechin.

Hab. North and south shores of the Mediterranean, île d'Oléron, and Madeira.

These facts are interesting as showing that the Seal which was formerly believed to be confined to the north shore of the Mediterranean is also found on the southern one and on the islands of the Atlantic.

Nilsson, in his excellent monograph on the genus, after having examined all the materials that he could find in the different museums, reduced the number of species of Seals to fourteen.

We have now in the British Museum, as by the following list will appear, twenty-four most distinct species, established upon the examination of the osteological as well as the external characters of the animals.

1. *Lobodon carcinophaga,* Gray, Cat. p. 10. Antarctic Ocean.
2. *Stenorhynchus leptonyx,* Gray, Cat. p. 13. Antarctic Ocean.
3. *Leptonyx Weddellii,* Gray, Cat. p. 16. Antarctic Ocean.
4. *Monachus albiventer,* Gray, Cat. p. 18=*Heliophoca atlantica,* Gray. North and south shores of the Mediterranean; Madeira.
5. *Monachus? tropicalis,* Gray, Cat. p. 28. Jamaica.
6. *Ommatophoca Rossii,* Gray, Cat. p. 19. Antarctic Ocean.
7. *Callocephalus vitulinus,* Gray, Cat. p. 21. North Seas.
8. *Pagomys fœtidus,* Gray, Cat. p. 23. North Seas.
9. *Halocyon Richardii,* Gray, P. Z. S. 1864. Vancouver's Island.
10. *Pagophilus grœnlandicus,* Gray, Cat. p. 25. North Sea.
11. *Phoca barbata,* Gray, Cat. p. 27. North Sea.
12. *Halichœrus Grypus,* Gray, Cat. p. 30. North Sea.
13. *Trichechus Rosmarus,* Gray, Cat. p. 32. North Sea.
14. *Morunga elephantina,* Gray, Cat. p. 34. Antarctic Ocean.
15. *Cystophora cristata,* Gray, Cat. p. 36. North Sea.
16. ——? *antillarum,* Gray, Cat. p. 38. Jamaica.
17. *Arctocephalus monteriensis,* Gray, P. Z. S. 1859, p. 358, t. 72. California.
18. —— *Hookeri,* Gray, Cat. p. 45. Falkland Islands.
19. —— *lobatus,* Gray, Cat. p. 44. Australia.
20. —— *nigrescens,* Gray, P. Z. S. 1859, p. 109. Falkland Islands.
21. —— *Gillespii,* Gray, P. Z. S. 1859, p. 110, t. 70. California.
22. —— *Delalandii,* Gray, P. Z. S. 1859, p. 107, t. 69. Cape of Good Hope.
23. *Callorhinus ursinus,* Gray, P. Z. S. 1859, pp. 103, 359, t. 68. Behring's Straits.
24. *Otaria leonina,* Gray, Cat. p. 47; P. Z. S. 1859, p. 360. Southern Pacific Ocean.

Besides these species, I have very little doubt that the *Phoca caspica* of Nilsson, from the Caspian Sea, the *Leo marinus* of Steller, from Behring's Straits, and *Pagomys nummularis*, from Japan, are distinct. I am not aware that the *Leo marinus* of Steller exists in any museum; the specimen we received from the St. Petersburg Academy under that name is the *Callorhinus ursinus* of the 'Proceedings of the Zoological Society' for 1859.

Notice of a New Species of Goliathus. By G. R. Gray.

Dr. Kirk has, on his return from the Zambesi, added to our knowledge a species of the genus *Goliathus*, which he obtained as long ago as November 1858, when he picked it up among the hills of Kebrabassa, which is situated about forty miles beyond the Portuguese town of Tete. As it appears to be new, I have ventured to lay a description of it before the Society under the name of *Goliathus Kirkianus*.

♂. Castaneous black, with the upper part of head, the seven narrow longitudinal lines on the thorax, the base, and outer edges of the elytra broadly margined, also with a series of narrow irregular transverse lines on their centres of a pearly white. The bifurcated horn in front of the head, all beneath the body, and legs deep castaneous; the four hind legs fringed inwardly with pale rufous hairs. Scutellum of a long-triangular form, castaneous black, with a short narrow longitudinal line in the centre of a pearly white.

Of the known species it approaches most nearly to the *Goliathus Fornassinii*, from which, however, it differs in the form of the head and thorax: the former is longer, with the bifurcated horn in front shorter, while each fork of it is broader, with the apex of each broadly truncated; the latter is less rounded, with the sides subangulated in the centre, thus differing from the figure of the head of the male given in the 'Ann. de la Soc. Ent. de Fr.' iv. pl. 7. f. 1*a*.

Feb. 9, 1864.—John Gould, Esq., F.R.S., in the Chair.

Third Contribution to our Knowledge of Batrachians from Australia. By Dr. A. Günther.

The following is a continuation of two other papers treating on the same subject; they were published in the 'Annals and Magazine of Natural History,' 1863, p. 26, and in the 'Proceedings' of this Society, 1863, p. 249.

Mixophyes (g. n. Ranidarum).

Habitus as in *Rana*, the head being broad and large; legs of moderate length. Tongue circular, not notched behind; vomerine teeth in two series; lower jaw without tooth-like apophyses. Openings of the Eustachian tubes narrower than the choanæ; tympanum distinct. Fingers free, none opposite to the others; interdigital membrane between the toes well developed; fifth toe moveable to its base; a long, compressed, subsemicircular tubercle at the meta-

tarsus. Male with a single subgular sac, which is not visible externally.

MIXOPHYES FASCIOLATUS.

This Batrachian approaches the true Frogs more closely than any other known from the Australian region; its habitus is that of *Rana*, but the head is disproportionally large and broad. The snout is obtusely rounded, with the canthus rostralis gradually descending in a gentle curve, and with the loreal region obliquely flattened. The nostril is scarcely below the canthus, midway between the eye and the end of the snout. The eye is large, prominent. Cleft of the mouth very wide, much broader than long. The vomerine teeth are in a nearly straight line, between the anterior angles of the choanæ, the two series being separated in the middle by a narrow space. Two long slits on the side of the tongue lead into the subgular sac. The tympanum is nearly as large as the eye. With the exception of a very slight fold above the tympanum, the skin is perfectly smooth.

Fingers tapering, rather slender. The length of the body equals the distance between vent and heel, but it is much more than the length of the remaining foot. Toes two-thirds webbed, so that the three outer phalanges of the fourth toe remain free.

Upper parts brownish olive, with a darker cross band between the hinder half of the superciliaries. A black band runs along the canthus rostralis, widening on the foremost part of the snout below the nostril, and is continued behind the eye, above the tympanum; sides of the body with round brown or black spots; legs with numerous black cross bands, which are most distinct on the hinder side of the fore legs and on the anterior side of the hind limbs. Lower parts uniform white; throat of the male brownish.

Specimens of this Frog have been sent by Mr. Krefft from the Clarence River; the following are the dimensions of an adult female:—

	lines.
Length of the body	33
Width of the mouth	14
Length of the fore limb	23
——— of the third finger	7
——— of the hind limb	54
——— of the entire foot	23
——— of the fourth toe	$15\frac{1}{2}$

PTEROPHRYNUS AFFINIS.

Habit as in *Camariolius varius*, Peters, but with the snout longer and more pointed; the canthus rostralis is rather distinct between eye and nostril, and is strongly deflexed in front. Upper parts smooth, the lower coarsely granulated. Eye rather large, not much shorter than the snout. Tongue narrow, ovate, entire behind; vomerine teeth none, but there is a short, scarcely perceptible osseous ridge in front of the orbital groove. Toes not fringed; tarsus with a longitudinal fold of the skin; metatarsus with two minute tubercles.

The length of the body is more than the distance between vent and metatarsal tubercles. Upper parts reddish olive, with a double series of irregular blackish spots along the back; a black band runs from behind the eye along the side of the body towards the loin, a blackish streak along the canthus rostralis. Lower parts whitish.

	lines.
Length of the body	12
——— of the hind limb	16
——— of the fourth hind toe	5
Distance between vent and knee	$4\frac{1}{2}$

Hab. Western Australia.

Having found in the collection of the British Museum a specimen of *Pterophrynus verrucosus,* Lütken, I convinced myself that the slight swelling of the skin between the angle of the mouth and the shoulder is not produced by an accumulation of glands, so as to deserve the name of a parotoid. The processes of the sacral vertebra are so slightly dilated, that they might be described as cylindrical; however, each process terminates in a cartilage, which is very distinctly dilated. On comparing this Frog with the *Camariolius* of Peters, I came to the conclusion that both these genera must be united; for although Professor Peters describes the processes of the sacral vertebra as narrow, I find them in *Camariolius varius,* Peters, as slightly dilated as in *Pterophrynus.* Probably any one who had no opportunity of observing the following species would have overlooked the dilatation of those processes in the species mentioned. *P. lævis* has them very distinctly dilated, and *P. affinis* and *P. tasmaniensis* are, in this respect, intermediate between these extreme forms. They form only one genus, which, perhaps, must be still further extended; for, whilst none of the species mentioned are provided with vomerine teeth, several specimens in our collection, which, perhaps, are the *Cystignathus Georgianus* of D. & B., and which can scarcely be generically separated from our *Pterophryni,* have those teeth well developed. Tschudi has proposed the name of *Crinia* for the last-named species.

Pterophrynus tasmaniensis.

Very similar to *Camariolius pictus,* Peters; upper and lower parts nearly entirely smooth, with scarcely any trace of flat tubercles. Snout rounded in front, somewhat pointed, sloping downwards in a gentle curve from the nostrils. Eye of moderate size, rather longer than its distance from the nostril. Tongue narrow, ovate, entire behind; vomerine teeth none. Toes fringed; *tarsus without longitudinal fold*; metatarsus with two minute tubercles. The length of the body equals the distance between vent and metatarsal tubercles. Upper parts blackish brown, with a more or less distinct broad reddish-olive band running from behind the eye towards the loin; lower parts beautifully rose-coloured, largely marbled with black; the preanal parts black.

	lines.
Length of the body	13
——— of the hind limb	19
——— of the fourth hind toe	6
Distance between vent and knee	5

Hab. Van Diemen's Land.

PTEROPHRYNUS LÆVIS.

Habit as in *Pseudophryne*; snout rather short and rounded, with the canthus rostralis obtuse. Eye considerably shorter than the snout. Upper and lower parts perfectly smooth. Tongue narrow, ovate, entire behind; vomerine teeth none. Tympanum very small, covered not only by the skin, but also by muscle. Toes not fringed, without subarticular tubercles; neither a tarsal fold nor metatarsal tubercles are present. The length of the body is not much less than that of the hind limb. Brownish olive; small yellow spots are scattered over the upper parts; numerous brown spots on the belly and on the lower side of the hind limb.

	lines.
Length of the body	13
——— of the hind limb	16
——— of the fourth hind toe	$5\frac{1}{2}$
Distance between vent and knee	$4\frac{2}{3}$

Hab. Van Diemen's Land.

LITORIA WILCOXII.

Snout of moderate length, somewhat pointed in front, the distance between the front angles of the orbits being equal to that between the eye and the extremity of the snout. Canthus rostralis angular; nostril much nearer to the end of the snout than to the eye. Tympanum very distinct, half the size of the eye. Skin perfectly smooth; a fold across the chest; belly granulated. Vomerine teeth in two oblique short series between the anterior part of the choanæ; tongue entire behind. Openings of the Eustachian tubes much narrower than the choanæ. Limbs rather slender: the third finger is longer than the fourth. The length of the body is a little less than the distance between vent and heel. Tarsus with a lateral fold of the skin; metatarsus with two small tubercles. Toes three-fourths webbed; the length of the fourth toe is a little less than one-half of that of the body. Disks rather small.

Upper parts greyish olive, indistinctly marbled with darker; *a dark cross band between the eyes.* A black band runs from the snout along the canthus rostralis, and is continued behind the eye, across the tympanum, to behind the axil. Sides of the belly and hinder side of the thigh yellow, marbled with black.

	lines.
Length of the body	19
Width of the cleft of the mouth	$6\frac{2}{3}$
Length of the fore limb	$13\frac{1}{2}$
——— of the third finger	$4\frac{1}{2}$

	lines.
Length of the hind limb	35
——— of the entire foot..................	15
——— of the fourth toe..................	9

Two specimens were sent by Mr. Krefft; they were collected at the Clarence River by James F. Wilcox, Esq., to whom science is indebted for many valuable acquisitions from that country.

I take this opportunity of remarking that *Hyla aurea*, Less., has the first finger opposite to the three others, and that therefore it ought to be referred to the genus *Litoria*.

Halophila platydactyla.

This species is very similar to *H. vitiana*, Bibr., but distinguished by the very broad terminal disks of the fingers, which are as large as the tympanum. In the form of its head it agrees with the other species mentioned; the tympanum is not quite half as large as the eye; the choanæ and openings of the Eustachian tubes are small, and the minute vomerine teeth form only a very short oblique series behind the choanæ. The skin is perfectly smooth. The first finger is shorter than the others. The length of the body is more than the distance between vent and heel. Toes with a rudimentary web, and with the terminal disks much smaller than those of the fingers; the third toe is longer than the fifth; metatarsus with two minute tubercles. Uniform brownish violet above; light brownish below.

Length of the body 16 lines, of the hind limb 22 lines, of the fourth toe 7 lines, of the fore limb $11\frac{1}{2}$ lines.

The locality where this species has been obtained is not known, but it is probable that it came from one of the Feejee Islands.

MISCELLANEOUS.

Notice of a new Genus (Silurana) *of Frogs from West Africa.* By Dr. J. E. Gray, F.R.S. &c.

Mr. Moore, of the Free Museum, Liverpool, has kindly sent to me for examination some young Frogs and their larvæ which he has lately received. They are peculiar for having a very long beard, like the cirri of a *Silurus* or Cat-fish, on each side of the mouth. The larva has the flat head and much the appearance of that genus of fish.

Silurana (Fam. *Dactylethridæ*).

The mouth with an elongated beard on each side, at the angle of the gape. Tarsus with a spur at the base of the first toe; the rest like *Dactylethra*.

The larva with a very broad flat head, and a very long beard at the angle of the mouth on each side: this beard in the larva is as long as the body; it is shorter and thicker in the specimens which have their fore and hind feet well developed but still retain their tail. The tail is compressed, finless above, but with a broad, well-developed membranaceous fin extending the whole length of the lower edge.

Silurana tropicalis.

Olive-green, smooth, pale beneath. The webs of the hind feet are broad, white, semitransparent; the claws on the three inner toes are well developed and black.

Hab. West Africa, Lagos. Brit. Mus. Collected by R. B. N. Walter, Esq.

The *Dactylethra Mülleri* of Dr. Peters, from Mozambique, and of Mr. Cope, from the Gaboon, most probably belong to this genus: but the beards are described as being placed "below the eyes;" in this animal they are far in front of the lower part of the eye, and situated at the angle of the gape, as in many *Siluri* and other fishes with bearded mouths.

Note on Lepas anatifera.

16 Union Terrace, Aberdeen.
Sept. 12, 1864.

Dear Sir,—I send you a photograph of rather a remarkable specimen of the common Barnacle (*Lepas anatifera* of Linnæus), which was picked up by the fishermen in the Bay of Aberdeen a few days ago, and which you might notice in the 'Annals' if you think it worthy.

The log of wood is about 27 feet long, and 16 inches in diameter, three sides of which are covered with millions of these animals in high perfection. The Barnacles, as they lie about it, make a diameter of 2 feet 9 inches, and, floating in the water, they spread out to a width of 4 or 5 feet. The shell, in the greater number, is fully $1\frac{1}{4}$ inch long, while the peduncle is, in many, 18 inches.

I am not aware of the Barnacle having been seen before in this part of the country, though I believe it is occasionally found on the western coast.

It is probable that the pine-log to which the animals are attached must have floated from a southern latitude; so that an interesting problem is offered to science by its appearance in our bay.

I am, Sir,
Your obedient Servant,

To W. Francis, Ph.D., F.L.S. Ro. Dyce, M.D., F.R.S.E.

On the Anatomy of the Balanophoreæ, as regards the Characters which it furnishes for the Classification of those Plants. By M. A. Chatin.

The Balanophoreæ, with the Cytineæ and Rafflesiaceæ constitute a singular class of parasitic plants, which has received the name of *Rhizantheæ*; their flowers, which are sometimes small and grouped together, sometimes very large and solitary, often appear to push forth, like Mushrooms, from a sort of subterranean byssus.

Their seed, which has been the subject of valuable investigations on the part of Messrs. Weddell, J. D. Hooker, Griffith, and Hofmeister, has its embryo formed only by a homogeneous cellular mass, like the spores of Cryptogamic plants—a simplicity of organization

which has led to the Rhizanths being regarded as degraded plants forming a peculiar group between Cryptogamia and Phanerogamia. My investigations are not in favour of this opinion; they tend rather to lead one to assign the Rhizanths a place between the Monocotyledons and Dicotyledons, most closely approaching the former by their peculiar structure, and the latter by their affinity to certain orders. It is especially by the structure of the stamen, and also by that of the ovule, that the Rhizanths are elevated in the vegetable scale.

From the totality of the data furnished by the anatomy of the genera and species, I obtain the following anatomical diagnosis for the order Balanophoreæ:—*Spiral vessels* rare and never capable of being unrolled; true *cortical fibres* wanting; cells of the parenchyma generally with numerous *nuclei*; *sclerous tissues* frequent; *epidermis* (of the parts above ground) with its cells granuliferous and never exhibiting sinuous or zigzag outlines; *stomata* wanting; *rhizome* with scattered vascular bundles; *scale-like leaves* with several vascular bundles which are replaced sometimes by little columns of sclerous cells; *pericarp* divisible into several concentric zones, of which at least one (?) is of a sclerous nature; *anthers* having the second membrane (*endotheca* of authors) of a fibrous nature (except in *Balanophora*), with one or two layers of filamentous cells arranged in a spiral or radiate form (*en griffe*); the connective and the septa usually not fibrous, and destitute of placentoids.

The principal anatomical characters of the genera of Balanophoreæ are the following:—

Cynomorium.—Stem with bundles, some external or corticoid, small, simply fibrous; the others more internal and larger, fibro-vascular, and even furnished with spiral vessels, with fibre-cells intermixed with the vessels, and with a mass of delicate fibres or elongated cells forming the internal half of the bundles; rachis without spiral vessels and with elongated cells not limited to one side of the bundles; anthers with a destructible external membrane, with a fibrous membrane formed by a single layer of spiral cells, continued over the connective and the septum of the anther-cells; pollen elliptical, with three furrows and a finely tuberculate surface.

Balanophora.—Stem not completely deprived of spiral vessels, and showing but little development in the portion of the bundles which is formed by narrow and elongated cells; scales entirely destitute of vessels; anthers without a fibrous membrane, and capable of being reduced, when mature, to the exotheca alone; parenchyma with numerous nuclei (which well distinguishes *Balanophora* from *Phæocordylis*) and mixed with a few cells with the walls reticulated or as if cellular.

Helosis.—Rhizome with a sclerous medullary axis, lobate or stellate at its circumference, with a limited number (6–7) of bundles, arranged symmetrically in a circle, having their vessels united into a compact mass, upon the outer side of which is supported a ridge of delicate fibres covered at its point by a mass with a transverse subsemilunar section, composed of sclerous cells apparently occupying the place of cortical fibres; stem with scattered bundles, and with

vessels occupying the median and transverse portion of the bundles; rachis with a vascular mass forming the inner side of the bundles; bractea-scales with a single axile bundle, which is dilated above; parenchyma with very numerous nuclei; vessels never spiral.

Langsdorffia.—Stem with bundles arranged in a circle, and with a medulla not formed of sclerous cells; scales with several (usually seven) fibro-vascular bundles; nuclei and spiral vessels wanting or rare.

Lophophytum.—Rhizome with the corticoid or external layer well distinguished from the rest of the parenchyma by numerous sclerous nuclei, &c., and with an internal parenchyma entirely formed of cells with cellular walls; stem and axes of the floral capitula also in part composed of cellular cells; scales of the rhizome without vessels; those of the stem with the petiole (?) alone vascular (little columns of sclerous cells taking the place of the vascular bundles beneath the little nervures of the blade); pericarp with its subepidermic layer almost sclerous; anthers with their fibrous membrane composed, throughout the valves, of at least two layers of cells, the filaments of which are arranged in a sort of spiral; septa not fibrous, connective variable; spiral vessels entirely wanting.

Ombrophytum.—This genus, which is morphologically very similar to *Lophophytum*, with which it was long confounded, has two important anatomical characters—namely, the deficiency of cells with cellular walls, and the fibrous membrane of the anther-valves formed of cells with the fibres radiated (*en griffe*) instead of spiral, placed in a single layer towards the extremities of the valves. Anatomy thus fully justifies the separation of these two genera, originally proposed upon external characters which might appear not to be of sufficient value.

The species, like the order and the genera, are characterized anatomically. I may cite particularly *Lophophytum mirabile* and *L. brasilianum*, which are clearly distinguished merely by the structure of the anthers, the former alone having the tissues of the connective invaded by the fibrous cells of the fibrous membrane of the valves.

The affinities of the Balanophoreæ with other orders of plants find in their anatomy characters which either justify or invalidate the views founded originally upon external attributes. And at the same time that the true affinities obtain a more complete demonstration from the concordance of some anatomical characters, the necessity of keeping separate neighbouring orders is nevertheless made evident by important differential characters.

Thus the Cytineæ differ from the Balanophoreæ by the arrangement and general structure of the bundles of the stem and scales, by the nature of the vessels, and the structure of the anthers; the Nepentheæ and Aristolochieæ differ still more by the wood of the stem, the structure of the leaves and of the connective and valves of the anther, the general arrangement of the vessels, the ready unrolling of the spiral fibres, &c.

The comparative investigation of the Rafflesiaceæ, a family which has very intimate morphological relations with the Balanophoreæ, will constitute the subject of a special memoir which I shall submit to the Academy.—*Comptes Rendus*, July 11, 1864, p. 68.

Notice of a Skeleton of the Great Auk found in Guano near Newfoundland. By Dr. J. E. Gray, F.R.S., &c.

An almost perfect specimen of the Great Auk (*Alca impennis*), in a "mummy state," has been found on an island to the northward of Newfoundland, several feet below the surface of a deposit of frozen guano.

With the exception of the extremities of the toes, this example is perfect in every respect. Even the pen-feathers are on the wings. The beak is as perfect as on the day the bird died.

The specimen is on its way to the Zoological Department of the British Museum, to which it has been presented by its discoverer. I believe this is the third skeleton of this bird in European collections: there is one in Paris, and another in the possession of Mr. Alfred Newton, which was found also in guano.

Second Note on the Anatomy and Histology of Branchiostoma lubricum, *Costa* (Amphioxus lanceolatus, *Yarrel*). By M. J. Marcusen*.

MUSCULAR SYSTEM.

All observers before M. Quatrefages, and M. Quatrefages himself, agreed that the lateral muscles of the Lancelet have fibres with transverse striæ, and this I have been able to confirm; but with regard to the abdominal muscles, Müller was the first to indicate the singular fact that they have not striated fibres. M. Quatrefages also had not seen them, but it seemed to him that these muscles presented striæ during their contraction. In the muscles of the cirri of the buccal apparatus, and indeed of the entire ring, neither Müller nor Quatrefages saw the least trace of striæ. Quatrefages remarked that the abdominal muscles presented a singular exception, as in the entire vertebrate series they are under the influence of the will, and in all other forms present striæ. I find that this exception has no existence. The abdominal muscles of the Lancelet are composed of primitive fibres with transverse striæ; and the muscles of the cirri, of the buccal ring, and of the fold which separates the mouth from the branchial cavity are also muscles with transversely striated fibres. The primitive fibres of these muscles are very delicate, which may perhaps prevent the striæ from being seen unless the animal be dissected, especially as, at this point, they have rather the character of tendons. Müller thought he saw muscles in the midst of the branchial arches; but I have been unable to find them.

CONJUNCTIVE TISSUE.

This is completely transparent and nearly gelatinous, or it presents the form of a fibrous tissue in which many elastic fibres are found; the latter may be either long or short. The long fibres are met with chiefly in the fin; the short ones, which are recurved at

* See 'Annals,' August 1864, p. 151.

the two extremities, occur principally in the conjunctive tissue which covers the branchial cavity.

VASCULAR SYSTEM.

Besides the large vessels so well described by Müller, there is a well-developed capillary system throughout the body. The capillaries are met with in the central nervous system and in the muscles; but it is especially at the anterior and posterior extremities of the body, and in the delicate membrane which surrounds the body (*i. e.* the fins), that they are most developed. These capillaries are very delicate, transparent, and without nuclei in their walls; they are seen with difficulty when the body is covered with epithelium. In the fins they assume a longitudinal direction, and show many sinuosities and anastomoses. From the head to the tail they form around the central nervous system and dorsal cord a series of longer or shorter loops. They are met with in the interstices of the bundles of the lateral muscles. Quatrefages thought he saw a movement of blood in lacunæ; but these lacunæ are capillaries with walls: they are also found in the parts regarded by Müller as the fin-rays, and by Quatrefages as spinous apophyses, and it is in the opaque body which these enclose that they are to be seen with the elastic fibres and bodies of the conjunctive tissue. These capillaries are often filled with small, round, regular, slightly granulated bodies $\frac{1}{250}$th millim. or less in diameter, and apparently destitute of a nucleus: these are the blood-corpuscles of the *Branchiostoma*. I do not think that they are visible in the living animal; neither Müller, nor Quatrefages, nor myself was able to see them therein. I found them in specimens preserved in a solution of chromic acid. In any case, the vascular system of the Lancelet is more complete than has hitherto been supposed; and the blood, with its corpuscles, is distributed through it, as in other Vertebrata, in walled vessels, and not in lacunæ.

EPITHELIUM.

In the cells of the epithelium I could discover no nuclei. This was the case also with Quatrefages.—*Comptes Rendus*, July 11, 1864.

Note on the Great Auk. By Dr. P. L. Sclater, M.A., Sec. Z.S.

With reference to the list by Mr. Champley, in a recent Number of the 'Annals,' of the existing specimens of the skins and eggs of the Great Auk (*Alca impennis*), my friend Dr. G. Hartlaub, of Bremen, remarks to me, in a letter recently received, that it seems to be very incomplete. Dr. Hartlaub states that there is a very beautiful specimen of this bird in the Bremen Museum, also one at Leyden,—neither of which appear to be alluded to by Mr. Champley.

The Oldenburg collection is also in possession of one of the finest existing eggs of the Bird, which was acquired at the sale of the collection of the late Dr. Graba, of Kiel, for little more than a thaler!

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

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XXXVI.—*Remarks on* Stilifer, *a Genus of quasiparasitic Mollusks; with Particulars of the European Species* S. Turtoni. By J. Gwyn Jeffreys, F.R.S.*

In the course of my last dredging operations on the coast of Shetland, which were undertaken at the instance of the British Association, I obtained two full-grown and living specimens of *Stilifer Turtoni*, adhering to an *Echinus Dröbachiensis* of O. F. Müller, or *E. neglectus* of Lamarck. The Echinus was also covered with numerous clusters of egg-shaped spawn, which apparently had been deposited by one of the Stilifers.

I will not say, as is too frequently said on such occasions, that nothing or but little is known on the subject; this is not the case; but I will endeavour to add something to our knowledge of a curious mollusk, which is especially interesting in respect of its peculiar structure and habits, as well as of the difficulty felt by naturalists in assigning to it a correct place in the system of conchology.

For the discovery of this mollusk science is indebted to the indefatigable labours of the late Dr. Turton. In the 'Zoological Journal' for October 1825, an article by him, entitled "Description of some new British Shells," comprised one which he named *Phasianella stylifera*, and of which he says, "We found a dozen of these beautiful little shells alive, and attached to the spines of the *Echinus esculentus*, dredged up in Torbay." The reason which he gives for placing it in *Phasianella* is singular. It is that, in order to prevent the excessive multiplication of genera, he combined with that genus many of the smaller turbinated shells, such as otherwise answer to Lamarck's character, whether they have an operculum or not; and such as have the mar-

* Communicated by the Author, having been read at the Meeting of the British Association at Bath, Sept. 15, 1864.

gin of the aperture united all round he cast into the new genus *Cingulus*, after Dr. Fleming.

This last-named author, in his 'History of British Animals,' included in his genus *Velutina* Turton's little shell; but, after showing in what respects it differed from *Phasianella*, not less than from *Velutina*, he suggested that it should probably constitute a new genus, *Stylina*. That name, however, had been pre-engaged twelve years before by Lamarck for a tropical genus of stony Polypes, which he had originally called *Fascicularia*. Its adoption for the Mollusk also would therefore be contrary to usage, especially as the somewhat similar name of *Stilifer* has now been recognized for upwards of thirty years. I am aware that this is one of the questions of scientific nomenclature upon which naturalists are by no means agreed. I do not pretend to set myself up as a judge, and my opinion may be taken for what it is worth.

Mr. Broderip was the first to ascertain the zoological nature of the mollusk now under consideration; and in the 'Proceedings of the Zoological Society' for 1832 will be found an admirable communication from him on the subject. He there proposed the generic name which it still bears—*Stilifer*. A more detailed description of the animal, from his pen, will be presently given in full. The following remarks were appended to Broderip's memoir in the 'Proceedings of the Zoological Society:'—"Mr. Owen, to whom Mr. Broderip acknowledges himself indebted for the anatomical particulars which he had recorded of *Stilifer Astericola*, subsequently exhibited a series of drawings of the animal and of its various parts, so far as he had been able to observe them in the specimens brought home by Mr. Cuming. He also read a more detailed description of the peculiarities remarked by him during the dissection of the individuals which had been entrusted to him for that purpose." Some such drawings are engraved in Sowerby's 'Genera of Recent and Fossil Shells,' and the different parts are designated by letters; but, unfortunately, no reference was published, except to one of the figures.

Soon afterwards appeared one of the Numbers of Sowerby's 'Genera' containing an account of the present genus, with the signature of Mr. Broderip. The first syllable of the name *Stilifer* is here spelt (probably owing to a printer's error) with a *y*; in the 'Proceedings of the Zoological Society' it is correctly spelt with an *i*. The generic characters of the animal are as follows:—

Pallium crassum, carnosum, cyathiforme, testæ anfractus ultimos obtegens. Proboscis longissima, retractilis. Tentacula rotunda, crassa, subacuminata, ad basin proboscidis posita. Oculi ad basin tentaculorum sessiles, minimi. Branchiæ stirps solitaria. Animal marinum. Asteriæ cutem penetrans.

After the English version of these characters, a few more particulars are given,—viz. that the mantle is of a green hue, and has a small aperture at its base, and that on its ventral aspect is the rudiment of a foot. It is likewise mentioned that "Mr. Cuming found this elegant parasite burrowed in different parts of the rays of the oral disk of *Asterias solaris*. It is almost hidden from sight, so deeply does the animal penetrate into the substance of the Starfish, in which it makes a comfortable cyst for itself, wherein it most probably turns by the aid of its rudimentary foot. All the specimens infested with *Styliferi* appeared to be in the best health. Though there is reason to believe that they feed upon the juices of the Starfish, with that instinct of self-preservation imparted to all parasites, whose existence depends upon that of their nidus, the *Stylifer*, like the Ichneumon among insects, appears to avoid the vital parts; for in no instance did Mr. Cuming find it imbedded anywhere save in the rays, though some had penetrated at their base, and very near the pelvis." I must confess that I am not prepared to adopt this teleological mode of reasoning, so far as regards the *Stilifer*; because it does not appear that the Starfish has, in the calcareous and solid parts inhabited by its so-called parasite, any internal juices or soft tissue on which the latter can feed. The investing membrane is wholly external. Although the above description of the animal was undoubtedly correct and circumstantial, it must not be forgotten that it was drawn up from specimens which had been preserved for a considerable time in spirits. The examination of such specimens could not yield the same result, in a scientific point of view, as that of living individuals in their native habitat.

Our best British malacologist, Mr. Alder, is the only one who has noticed the animal of *S. Turtoni*. The specimen which he examined was rather injured, and in a very sickly state. He says, "It was white, had a rather large foot, without operculum, and a rounded head with two cylindrical tentacles, and minute eyes at the (external or posterior) base. No portion of the shell was covered by the fleshy parts; but we are not prepared to say that, in a state of vigour, the animal has not the power of extending some part of the mantle or foot over it. The remains of the animal, examined under a microscope, did not show any denticulated tongue." (I may add, by way of parenthesis, that Mr. Alder has, within the last few days, examined the soft parts of two more individuals which I sent him for that purpose, but failed to detect any traces of a spinous tongue.) He also observed that "the otolites are circular, with a central dot, that the gill consists of a single series of triangular lobes, and that the mouth

breaks up into squarish angular fragments, not crystalline, perhaps horny."

In 1850, Mr. Arthur Adams, one of the authors of a work so indispensable to all students of general conchology ('The Genera of Recent Mollusca'), published in the 'Voyage of the Samarang' some interesting details with respect to the animal of another species of *Stilifer*. This species he named *S. astericola*, erroneously supposing it to be identical with the one described by Broderip; but afterwards, finding out his mistake, he substituted *ovoideus* as the specific name of his *Stilifer*. His diagnosis is as follows:—

> "Tentacles slender, subulate, simple. Eyes sessile at the outer bases of the tentacles. Mantle enclosed. Foot linguiform, forming an elongated anterior lobe, rudimentary behind."

As will be presently seen, the animal of the European species differs in several respects from the above description. Its tentacles are thick, cylindrical, and more or less strangulated, instead of "slender, subulate, simple;" the eyes are not placed "at the outer bases of the tentacles," but behind them on the neck; the mantle is always expanded over part of the shell during the lifetime of the animal, and never "enclosed," nor is it even withdrawn at its death; and so far from the foot being "rudimentary behind," it is well developed, and peculiarly constructed. The animal of *S. Turtoni* is, besides, ciliated all over—a character which distinguishes it at once from any species of *Eulima*, with which it has been usually associated in works treating on the classification of the Mollusca. Perhaps this character may have been hitherto overlooked.

Messrs. Adams, in their 'Genera,' added some further information as to the habits of *Stilifer*:—

"These singular animals are parasitic in the skins of Starfishes, burrowing beneath the surface, and producing tumours, often of a considerable size. When removed and placed in water, they do not appear to possess much locomotive power, but extend the tongue-shaped foot, and use it as an exploring organ."

The 'Journal de Conchyliologie' for 1851 contains a notice by M. Petit de la Saussaye of the present genus, and a description of a new species, *S. Mittrei*. He added nothing to our knowledge of the animal, but attributed a greater antiquity than had been supposed to the discovery of *Stilifer*, in a purely conchological point of view, by identifying the *Helix corallina* of Chemnitz as the original species. Chemnitz says that he found

a dozen specimens of the shell which he had thus provisionally named in the crevices of Madrepores and other stony corals that had been collected on the shore of one of the West-India Islands for the purpose of being burnt into lime, and had formed part of the ballast of a vessel bound to Europe. As the corals had lain on the beach for a long time, Chemnitz thought the shells might have been terrestrial, and not marine. Mistakes of a similar kind have been made by modern conchologists—e. g., *Halia Priamus*.

M. Hupé, the able and courteous curator of the natural-history collections in the Jardin des Plantes (whose knowledge of the recent Echinodermata is very extensive), published in the 'Revue et Magasin de Zoologie' for March 1860 a description of another species, under the name of *Stylifer Orbignyanus*. While examining a specimen of *Cidaris imperialis*, Lam., from New Holland, he noticed that two of the spines were unusually enlarged, tumid, and irregularly spherical; at their base he observed two small vertical slits, like button-holes, placed opposite to each other. A section of these spines showed that in the cavity of one was enclosed an adult Stilifer, and in the other, two specimens, which were also adult, besides several embryonic shells. With respect to the mode by which the Stilifer had thus become enclosed, M. Hupé was of opinion that the cavities were not made by them, but that the interposition of some part of the mollusk had prevented its being completely imprisoned in the spine during the progress of the growth of the Cidaris, which would otherwise have enveloped and smothered the Stilifer. He was kind enough to show me the specimens; and they seemed to present an analogous case to that of *Stilifer astericola*, which I had examined in Mr. Cuming's collection.

Lastly, I would cite an excellent monograph by Dr. Fischer, which appeared in the 'Journal de Conchyliologie' for April last, on the genera *Stylifer* and *Entoconcha* (p. 91 &c.). In this monograph all the known species of *Stilifer* are redescribed, and a new one (*S. Paulucciæ*) well described and figured. According to Fischer, the *Entoconcha mirabilis* of J. Müller, found in *Synaptæ* at Trieste, is probably the fry of some other mollusk. At all events, we want more information about it. It is almost microscopic.

But to return to *Stilifer*. Fischer suspected that it is not a true parasite. He says that the discovery by M. Hupé proves that, although living like a parasite on the tegumentary system of the Echinoderms or their appendages, the *Stilifer* does not feed on their substance, as has been supposed. Its nourishment comes with the sea-water through the openings of the cavity which it occupies: perhaps its proboscis may be pro-

truded for the purpose of seeking this nourishment. I need not say that the reputation of Dr. Fischer as a physiologist, especially with regard to the Mollusca, makes any opinion of his on such subjects very valuable. I share his incredulity as to *Stilifer* being a parasite in the ordinary meaning of the word; but my impression is that it feeds on the excretions of Echinoderms, and not on animalcules or other organized and living matter with which sea-water abounds. It has never been found except on Echinoderms, or imbedded in their rays or spines. All the specimens of *Stilifer Turtoni* which I have seen *in situ* (and they have been rather numerous) occupied the *upper* sides of *Echini*, in the area of the vent or anal opening. The *Echini* so infested appeared to be invariably in perfect health and vigour. The Shetland specimen of *E. Dröbachiensis* was carefully watched by me for more than twelve hours. Its tubular suckers and pedicellariæ continued in active although intermittent motion during all that period. The Stilifers were nestling or slowly crawling about among the spines; but they did not touch any of the suckers of the Echinus, which, being retractile, could easily have been withdrawn into the test; nor could I detect either of the mollusks in the act of feeding on the outer membrane or any other part of the Echinus. At the same time it is clear that there is some connexion between the peculiar habitat selected by the Stilifer and its food; for if it subsisted on any living organisms, it would hardly confine itself to Echinoderms, but have a more varied range of habitat. Such shelter as an *Echinus* or *Asterias* could afford might be as easily obtained in crevices of rocks or in the cavities of deserted shells. Consequently, although I do not consider this a case of true parasitism, like that of the mistletoe among plants, neither would I refer it to epiphytism, like that of a tropical orchid. It rather reminds one of the scavenger-habits of dung-beetles.

I have elsewhere * endeavoured to show that the pretty little bivalve shell called *Montacuta substriata*, which also infests various Echinoids, is not really a parasite. This always occupies a different part of the *Echinus* from that where the *Stilifer* takes up its abode; it adheres by its byssus to the ventral spines near the opening of the mouth on the *under* side. Here it probably avails itself of the current or indraught excited by the ciliary action of the *Spatangus* or other Echinoid for its own purposes; and both partake of the same food in amicable but unconscious relationship to each other. As far as I have been able to observe, the *Stilifer* does not cause more inconvenience than the *Montacuta* to its not unwilling host.

The suctorial proboscis, as well as the want of a denticulated

* British Conchology, vol. ii. p. 208.

tongue in *Stilifer Turtoni*, strengthens the supposition that its food consists of extremely soft or semifluid matter, and not of organisms which have any degree of solidity. *Dentalium*, which preys on Foraminifera and other minute animals, has (according to Lacaze-Duthiers) a very complicated lingual apparatus; and even the little *Rissoa*, which feeds on seaweeds, often of the most delicate and filmy texture, possesses a pair of horny jaws and a tongue armed with a strong central tooth, which is flanked on each side by a formidable row of serrated lateral teeth. *Stilifer* has no jaw or tooth of any kind.

The late Mr. Stewart, of the College of Surgeons (whose untimely death is still deplored by all who study the British Echinodermata), was of opinion that *Stilifer Turtoni* infested *Echini* for the sole purpose of depositing its spawn. We know, from the observations of Mr. Peach, that *Lamellaria perspicua* frequents the shore at Wick, between tide-marks, every summer, and makes a nidus for its spawn in a species of *Botryllus*. But *Lamellaria* is not, like *Stilifer*, restricted to a particular habitat. The former attaches itself to the under side of loose stones, and is also found generally distributed over the sea-bed, except perhaps in the spawning-season. The *Echini* on which *Stilifer Turtoni* have been taken are very rarely covered with spawn; and Stilifers of all ages, from one to half-a-dozen, occur on *Echini*, but nowhere else.

The fecundity of *Stilifer* is very great; and it therefore ought not to be a rare shell. I counted at least 100 fry in one of the clusters of spawn on the back of the Shetland sea-egg; and as there were 41 of these clusters, this would yield a prospective harvest of more than 4000 specimens—enough to supply almost all the conchologists in the world. Moreover one of the adult Stilifers appeared to be full of spawn. As the Echinus probably could not accommodate more than half a dozen Stilifers when they came to maturity, what would have become of the rest, supposing any of them escaped being the prey of other animals? Would they migrate, and form colonies on other *Echini*? They have feet and eyes; and suitable habitations are not wanting in the same part of the sea-bed where I procured the specimen which have given rise to the above remarks.

Various have been the positions which conchologists have from time to time, assigned to this remarkable mollusk in their systems of classification. Turton placed it in *Phasianella*; Fleming in *Velutina*, but with doubt; Reeve at first between *Turritella* and *Cerithium*, but recently between *Canalifera* and his *Turbinacea*; Macgillivray among his *Turbinina*, and next to *Lacuna*; Forbes and Hanley, as well as Woodward, in *Pyramidellidæ*; H. & A. Adams as a distinct family between *Euli*-

midæ and *Cerithiopsidæ*; Clark in *Pyramidellidæ*, between *Aclis* and *Scalaria*; and Gray also in the same family, between his genus *Hyala* (*Rissoa vitrea*) and *Entoconcha*. I am inclined to agree with the Messrs. Adams in making *Stilifer* the type of a separate family; but it is much more difficult to say to what other families it has the nearest affinity. *Pyramidellidæ*, as represented in our seas by *Odostomia*, ought not to be far separated from it; and *Ianthinidæ* have similar relations to it in respect of the nucleus or apex of the shell. *Homalogyra* has sessile eyes placed on the neck, as in *Stilifer*, but has no tentacles; and it is also finely ciliated all over.

The presence or absence of an operculum is evidently not a character of sufficient value to distinguish one family, or even one genus, from another, seeing that some species of the same genus (e. g. *Mangelia*) possess an operculum, while their congeners (although closely allied in all other respects) have none.

The styliform character of the spire in this genus, although remarkable, is not peculiar to it, or to *Odostomia*, *Turbonilla* (or *Chemnitzia*), *Eulimella*, or *Ianthina*. *Melampus bullæoides* has the apical whorls formed in the same mamillated fashion; and in several genera of *Bullidæ* the shell exhibits the same feature. These, however, may be regarded as cases of analogy rather than of affinity. The nucleus of the spire, or first-formed whorls, in many univalves ceases to be occupied by the animal after it has attained a certain growth, being too small for its requirements—like a householder, who usually moves, once at least during his life, into a tenement larger than the one he at first inhabited. In the case of the Mollusca above referred to, the original and now useless tenement remains fixed to the new one; but in *Bulimus decollatus*, some species of *Clausilia*, and in *Truncatella truncatula* the topmost story is knocked off and replaced by a partition wall. *Cæcum glabrum* and *C. trachea* even undergo partial metamorphoses, the shell of each having at first a regular spire, and, when this is lost, becoming a slightly curved cylinder. The genera *Leptoconchus* of Rüppell and *Campulotus* of Guettard (*Magilus*, Montfort) also appear to be related to *Stilifer* in their quasiparasitic habits. The first-named genus is destitute of an operculum, except in its younger state; the other has an operculum at all ages (Deshayes, Moll. de l'île de Réunion).

The conjecture of the late Professor d'Orbigny that *Stilifer* ought to merge in *Eulima*, and that the latter may be also parasitic, has no foundation. It is true that species of *Eulima* have been found in the stomachs of *Holothuriæ*; and the "trepang," or dried bêche de mer, of which the Japanese are so fond, frequently contains these shells. But this is not a case of parasitism: the *Eulima* feeds the *Holothuria*, instead of feeding upon it.

Let me say a few words as to the name of this genus and the European species. Although the Greek orthography is followed in our word *style*, it is clear that the Latin word *stilus* was not spelt with a *y* : it is, of course, from this latter word that *Stilifer* is derived. Whether it is correct to form a generic name with an adjective may be very questionable; but use has sanctioned it in the present instance, as well as in *Spirifer*, *Stiliger*, *Lobiger*, *Ianthina*, *Vitrina*, and many others of general acceptation.

According to some purists, the specific name given by the discoverer, if subsequently adopted as generic, ought to be retained; so that the European species would be *Stilifer stilifer*. Precedents are not wanting for such a reduplication of the name under similar circumstances, e. g. *Volva volva*, *Turricula turricula*, &c. But it would be very inconvenient to alter the specific name *Turtoni*, which is so familiar to all conchologists, to say nothing of the inelegance of this system of nomenclature, or of its being contrary to one of the rules recommended by a committee of the British Association.

This specific name has been spelt, too, in different ways. We have *Galeomma Turtoni*, *Scalaria Turtonis*, and not only *Stilifer Turtoni* of Broderip, but *S. Turtonii* of Lovén. The termination of the proper name from which all these originated is a Greek, and not a Latin, form; and if it is to be so declined, the genitive would be *-is*, with the penultimate syllable short, as *Actæon*, *Actæonis*; *Alcmæon*, *Alcmæonis*, &c.: so *Turton*, *Turtonis*. But if we Latinize the name by adding *us* to it, the genitive would be *i* : *Turtonus*, *Turtoni*; just as *Galen* was *Galenus -i* in the works of ancient authors. I must offer an apology for this pedantic explanation, although it may be well to have the name in question uniformly spelt.

The following are all the known species of *Stilifer*, with such particulars of their geographical distribution and habits as I have been able to collect.

A. Spire short.

1. *Stilifer Turtoni*, Broderip.

Synonyms: *Phasianella stylifera*, Turton.
Stylifer globosus, Johnston (1841).
S. astericola, Brown (1844).
S. stylifera, Hanley (1844).
S. Turtonii, Lovén (1846).

Habitat. On *Echinus esculentus*, *E. saxatilis*, *E. pictus* (Norman, MS.) and *E. Dröbachiensis*, in from 20 to 80 fathoms, British and Scandinavian Seas.

This being local, and more especially the subject of the present paper, some further details of its distribution may be desirable.

British Isles.—Torbay, on *Echinus esculentus*, L. (*E. sphæra*, Müll.): Turton. Berwick, on *E. esculentus*: Johnston. Northumberland and Durham, on *E. pictus*: Alder, Howse, and Brady. Cork: Humphreys. Plymouth, on *E. saxatilis*: Stewart, Bate, and J. G. J. Shetland, on *E. Dröbachiensis*, Müll. (*E. neglectus*, Lam.): J. G. J.

(N.B. Although most Scandinavian naturalists consider the *Echinus neglectus* of Lamarck to be the same species as the *E. Dröbachiensis* of Müller's Prodromus to the 'Zoologia Danica,' it may be doubted whether the latter species is not the *E. Flemingii* of Ball. Müller's description is "hemisphæricus, pallidus, *spinis longis, albis*," which seems to agree better with *E. Flemingii* than with *E. neglectus*.)

The shell described by Professor Macgillivray, in his 'Molluscous Animals of Aberdeen, Kincardine, and Banff,' as *Stylina stylifera*, and stated to have been found by one of his pupils "adhering to an *Actinia* brought up by the lines," was the young of a common West Indian land shell belonging to the *Cyclophoridæ*. The habitat alone might have induced a suspicion that this shell was not our *Stilifer*; and I had an opportunity of ascertaining what it really was.

Scandinavia.—From Bohuslän in Sweden to the coast of Norway: Lovén. Christiania-fiord, Norway, on *Echinus esculentus* at Dröbak, and on fishing-grounds at two other places: Asbjörnsen. Bohuslän, in 20 fathoms, on *E. neglectus*: Malm.

Fischer also states that *Stilifer Turtoni* is not uncommon on *Echinus lividus*, near the mouth-opening; but he cites no authority for this unusual habitat. *E. lividus*, as is well known, excavates holes in slate and gneissic rocks, within tide-marks, and its lower surface is pressed closely to the stone.

Another instance of the same kind of mollusk infesting different Echinoids is that of *Montacuta substriata*, which has been found not only on *Spatangus purpureus*, but on *S. meridionalis*, *Amphidetus ovatus*, *Brissus lyrifer*, *Echinus esculentus*, and *Cidaris hystrix*.

2. *S. astericola*, Broderip.

Hab. Lord Hood's Island, on *Asterias solaris* (*A. helianthus*, Lam.): Cuming.

3. *S. Mittrei*, Petit.

Hab. Indian Ocean: Mittré.

4. *S. fulvescens*, A. Adams.

Hab. Isle of Labuan, in an *Asterias*: A. Adams.

5. *S. ovoideus,* H. & A. Adams.

Syn. *S. astericola,* A. Adams.

Hab. Borneo, in the body of an *Asterias*: A. Adams.

6. *S. Orbignyanus,* Hupé.

Hab. New Holland, enclosed in the spines of *Cidaris imperialis*: Hupé.

7. *S. robustus,* Pease.

Hab. Sandwich Isles, on *Echini*: Pease.

8. *S. apiculatus,* Souverbie.

Hab. New Caledonia?: Montrougier.

9. *S. eburneus,* Deshayes.

Hab. Isle of Bourbon, on *Echini* and *Asteriæ*: Maillard.

B. Spire long.

10. *S. corallinus,* Chemnitz.

Hab. West Indies, in madrepores and other corals: Chemnitz.

11. *S. subulatus,* Broderip.

Hab. West Indies?

12. *S. Barronii,* A. Adams.

Hab. Tropical seas, encysted in the integuments of an *Asterias*: Barron.

13. *S. exaratus,* A. Adams.

Hab. Philippine Isles, in the integuments of an *Asterias*: A. Adams.

14. *S. subangulatus,* A. Adams.

Hab. West Indies.

15. *S. Acicula,* Gould.

Syn. *Eulima vitrea,* A. Adams.

Hab. Fiji Isles, in *Holothuriæ*: United States Exploring Expedition.

16. *S. Pauluccię,* Fischer.

Hab. Red Sea, among the spines of *Echinus trigonarius,* Lam.: Marquise Paulucci.

Besides the above, may be noticed an undescribed or unnamed species dredged by Mr. M'Andrew off the Canary Isles (if it is not *S. Turtoni*), another collected at Guadeloupe by M. Beau, and five more, bearing the following names, but without de-

scription,—viz. *Stilifer Broderipii, S. Cumingii, S. fastigiatus,* and *S. solidus* of Adams's 'Genera,' and *S. pyramidalis* of Mr. Reeve. In the British Museum is an unnamed *Stilifer* from Port Natal, said to have been found attached to the mouth of a Starfish.

It is not improbable that some of the species enumerated in the 2nd section, having an elongated spire, may belong to *Eulima* or *Niso,* instead of to *Stilifer.*

I am not aware of any fossil species having been discovered.

I will now give the result of my examination of the animal of *S. Turtoni,* from notes made at the time.

Body white, and delicately stippled; the whole of the upper surface is covered with microscopical and extremely short cilia, which are in constant motion; these cilia are arranged in scale-like bunches, and by their action produce a circulating current.

Mantle thickened at its edges, and spread over the lower part of the shell, so as to form a disk.

Pallial fold, or branchial opening, on the right-hand side, forming a canal which terminates in an oval or roundish hole.

Head-lobes rounded and flattened, nearly transparent, one on each side a little below the snout or mouth.

Snout rather long when extended, but usually folded inwards and trunk-like, slightly bilobed, and placed between the tentacles and the foot.

Tentacles club-shaped, somewhat compressed, thick, and rather long, sometimes expanded at the tips, which are blunt and widely diverging, but united at their bases; they are more or less strangulated or constricted, usually at about one-fourth of the distance from their bases.

Eyes exceedingly small, seated on the neck or back of the head, at some distance behind the tentacles.

Foot tongue-shaped and elongated, bulbous and forming a creeping-disk in front, somewhat tubular in the middle, and tapering to a fine point behind; the sole, or under part, is slit in the middle for more than three-fourths of its length, the opening or commencement of the slit being near the bulbous part and oval.

Male organ spiked, and resembling an auxiliary tentacle.

Habitat. Whalsey Skerries, East Shetland, about 40 miles from land, in 80 fathoms, sandy bottom, on an *Echinus Dröbachiensis.* A pair of the *Stilifer* were attached to the sea-egg on its upper surface, between the spines near the vent or anal orifice; and the same part was also covered with about forty clusters of

spawn, which appeared to be in various stages of development. The adult Stilifers were not firmly attached to the Echinus (like the *Caligus* to a codfish), but frequently shifted their places by creeping between the spines. I gently removed one of them with a stiff camel's-hair brush, and placed it in a glass tube with sea-water. It was at first very sluggish or timid, and evidently unaccustomed to its new habitat, lying at the bottom of the tube; but afterwards it recovered itself, and crawled up the side by means of the front part of its foot, very slowly and by an imperceptible movement; the other part of the foot was not pressed to the glass, but rested on the mantle. The foot was occasionally twisted about and contracted, as if through uneasiness. The animal was never wholly withdrawn into the shell, although I irritated it with that object. The slit in the foot probably serves for the admission of water into some tubular cavity or vessels which permeate this organ: this would have the effect of enlarging and swelling the foot, so as to protect the Stilifer from being crushed by the spines of the Echinus. A slight leverage or action of this kind at the base of the spines would, of course, answer the purpose far better than a much stronger leverage or power exerted at the top of the spines. The fry are enveloped in a gelatinous case. When detached and examined under a microscope, each had three lobes, of which the two larger were in front; these were finely ciliated, the cilia being rather long, and their points sometimes touching the surface of the glass cell which contained the fry. The fry rapidly whirled themselves about by means of the cilia, but occasionally rested. They occupied nautiloid shells of a single turn.

One of the Stilifers appeared to be full of spawn-masses, which were perceptible with the microscope by reason of the shell being transparent. The other Stilifer was a male. I afterwards replaced the latter in its old quarters, where it was evidently more comfortable than in the glass tube; and it soon adhered to the sea-egg by the prehensile lobe of its foot, and settled down among the spines.

The ciliation of the body in *Stilifer* is also a characteristic feature of *Homalogyra* (perhaps the living representative of *Euomphalus*), which is a minute (but not microscopical) mollusk, without tentacles, and forms a discoidal shell. It is an inhabitant of the European seas, and comprises two species. Forbes and Hanley called one of these species *Skenea nitidissima*, and the other *Skenea Rota*. Dr. Fischer imagined that the first-named species was the fry of some larger mollusk, because it was ciliated; but he must have either overlooked the fact, or else not have been aware, that in all the species of *Trochus*, *Rissoa*, and

other genera the tentacles are ciliated, and also, in some species, other parts of the body. Mr. Clark was not more happy in his conjecture that *Homalogyra Rota* was the fry of *Cæcum Trachea*, the natural history of which this accomplished malacologist had so successfully investigated. I am not aware, indeed, that these shells or their animals have any character in common; besides which, it may be observed that the operculum of *Homalogyra* is flat and paucispiral, with an excentric nucleus, while that of *Cæcum* is more or less conical and multispiral, with a central nucleus, as in *Vermetus*. (Since this paper was read, I have received from the Marquis James Doria specimens of the young of *C. Trachea*, which he had dredged at Spezzia. The terminal part or spire is very different from that of *H. Rota*.)

The sexes in *Stilifer* appear to be separate, as may be seen from my description of the animal of *S. Turtoni*.

The shell of this species has been often described; but I will briefly allude to some of its characters, which have not been satisfactorily stated. The spire, for the first three whorls, is cylindrical and narrow; it then enlarges suddenly and disproportionately, and consists of three or four more whorls, which are rounded and extremely ventricose or swollen. The apex or nucleus of the spire is not reversed, although often set obliquely; it projects like the stump of a flagstaff which had been stuck in a slanting position on a steep mound. The columellar lip, in adult and perfect specimens, is slightly reflected. The lower part of the mouth is semicircular; it is not effuse or spread outwards, as in *Eulima* or *Aclis*.

XXXVII.—*Descriptions of Genera and Species of* Hispidæ. By J. S. Baly.

[Continued from p. 271.]

Genus Alurnus, Fabr.

Alurnus Batesii, n. sp.

A. oblongus, niger, nitidus; thorace rubro; elytris fulvo-flavis, maculis magnis tribus, triangulariter dispositis, punctoque humerali nigris.

Long. 11 lin.

Hab. Ega, Upper Amazons. Unique in the collection of Mr. Bates.

Oblong, shining black; thorax red; elytra bright fulvous yellow, three large patches on their surface, together with a small spot on each humeral callus, black. Head irregularly

punctured, vertex subrugose, portion of face below the insertion of the antennæ piceous; antennæ scarcely more than half the length of the body, their third joint elongate. Thorax one-fourth broader than long; sides subparallel, slightly rounded, sinuate near the base; posterior angles slightly produced, subacute, outer edge of rounded portion subsinuate; just behind the anterior angle is a deep notch, the angle itself being produced into a short obtuse tooth; above subcylindrical, irregularly excavated at the sides, surface covered with coarse punctures, which are irregularly confluent and subvariolose on either side; a narrow patch on the basal margin, in front of the scutellum, black. Scutellum semiovate, its apex emarginate; surface smooth and shining, impressed with a few scattered punctures; towards the apex is a broad, shallow, longitudinal impression. Elytra oblong-ovate, sides slightly rounded, subsinuate below the shoulders; apex acutely rounded, conjointly concave-emarginate at the suture, sutural angles acute; above convex, surface deeply but not quite so coarsely punctured as the thorax; behind the middle, on the inner disk, are several indistinct longitudinal ridges; the three large black patches are placed in a triangle on the surface, and arranged as follows:—the first, common, ovate, slightly emarginate at its upper edge, is situated immediately below the scutellum; the two others, larger and irregular in shape, are placed one on the disk of each elytron, scarcely below its middle; on the humeral callus is also a small round spot.

Genus Uroplata.

Many of the species to be described by me in this and the following papers are placed only provisionally in the present genus. *Uroplata*, as commonly understood, contains a vast number of apparently incongruous forms. I have been hitherto quite baffled in my efforts to break up these forms into smaller groups. Characters apparently most striking, and which, in other families, afford sure generic differences, here break down utterly, leaving the student more and more perplexed after each attempt to unravel and arrange this difficult group. I trust, however, that, by repeated efforts and continued study, I shall even yet succeed in my endeavours to divide the species into smaller but more natural genera.

Uroplata militaris, n. sp.

U. subcuneiformis, subdepressa, fulva; antennis nigris, thoracis margine laterali et vitta centrali, elytrorumque linea marginali prope apicem interrupta, fascia subapicali inter angulos posticos extensa, maculisque nonnullis obscure viridi-æneis: elytris apice ob-

tuse truncatis, angulo postico in spinam validam latam, dorso incrassatam, apice acutam, retrorsum paullo curvatam, lateraliter extensis; utroque quadricostato, costa tertia minus distincta, medio interrupta, apice abbreviata.

Long. $3\frac{1}{2}$ lin.

Hab. Ega, Upper Amazons.

Head smooth, finely granulose, moderately produced between the eyes; antennæ black, six basal joints smooth, nitidous, free from longitudinal grooves, moderately robust, subincrassate, basal joint slightly thickened, scarcely shorter than the second, third equal to the second, fourth and fifth each rather shorter, equal, sixth distinctly shorter than the fifth, seventh as long as the two preceding united, somewhat thickened, and, together with the four apical joints, forming an opake elongated club, its apex acute, and the sutural lines between the last four joints obsolete. Thorax twice as broad as long, much narrowed in front; sides narrowly margined, obsoletely crenulate, rounded, sinuate near the apex; anterior angles slightly produced into a subacute tooth; above subcylindrical, slightly depressed transversely near the base, basal lobe with a deep transverse groove; centre of disk faintly impressed with a narrow longitudinal grooved line; surface closely covered with large rounded punctures; fulvous, the extreme lateral border and an interrupted longitudinal line down the middle of the disk dark metallic green. Scutellum shining fulvous, the apical half of its surface horizontal, concave, its apex obtusely rounded. Elytra broader than the thorax, slightly increasing in width towards the posterior angles, the latter produced almost directly outwards into a broadly dilated acute spine, the apex of which is curved slightly backwards, its upper surface longitudinally elevated; sides narrowly margined, finely and somewhat distantly serrated; apical margin narrow, obtusely truncate, its edge serrate; above subdepressed, convex on the sides and apex; shoulders slightly prominent, but not raised vertically, their apex subacute; each elytron with four elevated costæ, the two outer ones less distinct than the others, the second from the lateral border being interrupted in the middle of its course; suture also raised; interstices deeply bigemellate-punctate. Beneath bright fulvous; anterior pair of thighs bidentate beneath, the hinder tooth long, acute; four hinder thighs also armed with a long tooth, the intermediate pair with a minute tubercle in front; tibiæ curved, the four anterior armed just within the apex with a short tooth.

Collection of Mr. Bates and my own.

Uroplata puella, n. sp.

U. elongata, subdepressa, obscure fulva; thoracis vittis tribus elytrorumque vittulis viridi-æneis: elytris serratis, utroque tricostato, angulo postico in laminam obtusam viridi-æneam modice lateraliter productis, apice obtuse truncatis; pedibus flavis; scutello nigro.

Long. 2 lin.

Hab. Brazil.

Head slightly produced in an obtuse angle between the eyes, vertex subopake, indistinctly grooved longitudinally; antennæ very robust, subincrassate, their basal joints short, nearly equal, the first being scarcely more swollen than the others; the three following from the third gradually decreasing in length, transverse; seventh nearly equal to the two preceding united, swollen, and forming with the four terminal joints a distinct club, the sutural lines between the last four obsolete. Thorax as broad at the base as long, sides narrowed from just above the extreme base to the apex, armed at their middle with two or more short teeth, anterior angles armed with an obtuse tooth; above subcylindrical, depressed and transversely excavated on the hinder disk, coarsely variolose-punctate; basal lobe oblique, transversely impressed. Scutellum quadrate. Elytra broader than the thorax, parallel in front, slightly dilated towards the hinder angle, surface of the latter irregularly thickened, sides and apical borders narrowly dilated, serrate; interspaces between the costæ deeply bigemellate-punctate.

This pretty little insect is not uncommon in collections.

Uroplata submarginalis, n. sp.

U. late cuneiformis, depressa, flavo-fulva, subnitida; elytris rufo tinctis; antennis rufo-fuscis, extrorsum pallidioribus; femoribus intermediis dimidio apicali nigro-purpureis: elytris apice oblique truncatis, tenuiter serratis, angulo postico in laminam compressam, trigonam, apice acutam, postice distincte serratam, lateraliter sat prominulam productis; utroque tricostato, interspatiis fortiter bifariam punctatis, interspatio tertio apicem versus confuse trifariam punctato; marginibus basali et apicali, angulo postico vittaque curvata submarginali ab humero ad angulum posticum extensa purpureis aut rufo-purpureis.

Long. $2\frac{1}{2}$ lin.

Hab. Ega, Upper Amazons.

Head very slightly produced between the eyes, vertex smooth; antennæ nearly one-third of the length of the body, moderately robust, subincrassate, joints cylindrical, two basal nearly equal, slightly thickened, third elongate, fourth nearly one-half shorter than the third; fifth and sixth still shorter, each decreasing in

length; seventh about equal to the fourth, incrassate, and, conjointly with the four terminal joints, forming a slender fusiform club; sutural lines between the last four obsolete. Thorax one-half broader than long, sides rounded and narrowed towards the apex, nearly straight and parallel at the base, above transversely convex, flattened and transversely depressed on the hinder disk, coarsely punctured, the punctures subrugose on the sides, more distant on the disk; basal lobe depressed. Scutellum oblique at the base, its apical half horizontal, its apex obtuse. Elytra much broader than the thorax, the shoulders obliquely rounded, lateral border narrow, serrate, interspace between the second and third costæ broad, impressed with three or more somewhat confused rows of punctures; on the hinder half of its surface is seen an indistinct ridge, which unites with the third costa just before its apex.

Collection of Mr. H. W. Bates and my own.

Uroplata pretiosa, n. sp.

U. subcuneiformis, subdepressa, supra flava; antennis, thoracis vittis tribus elytrisque nigris, his plaga humerali, fascia lata pone medium, margine dilatato lineaque marginali mox infra basin fere ad apicem exteriorem flavis; subtus fulva, pleuris, abdominis margine pedibusque nigris: elytris apice obtusis, angulo postico in spinam compressam acutam, lateraliter modice productis; utroque quadricostato, costa tertia medio interrupta.

Long. 3 lin.

Hab. Upper Amazons.

Head moderately produced between the eyes; vertex granulose, fulvous yellow, antennæ and a spot on the vertex black; antennæ moderately robust, slightly thickened towards their apex; all the joints distinct, two basal joints equal, cylindrical, the first thickened, third elongate, fourth and fifth each scarcely longer than the second, equal, sixth distinctly shorter than the fifth, seventh equal to fifth, three following joints each rather shorter than the seventh, also equal, the apical joint rather longer, acute. Thorax one-third broader at its base than long, sides rounded, nearly straight behind, narrowed and sinuate in front, anterior angles armed with a short obtuse tooth; above subcylindrical, transversely excavated near the base, coarsely punctured; fulvous yellow, a broad vitta down the middle, together with the lateral border, black; basal lobe short, deeply depressed. Scutellum shining black, curved, triangular, its apex obtuse. Elytra much broader than the thorax, slightly increasing in width towards their apex; sides narrowly margined, their outer edge serrate, margin slightly dilated towards the posterior angles, which are produced obliquely outwards and

backwards into a flattened acute tooth; apex obtusely rounded, apical margin slightly dilated, its outer edge serrate; above flattened along the suture; each elytron with four raised costæ, the third obsolete in the middle, suture also elevated, interstices each with a double row of deep, large, regular punctures. Beneath bright fulvous; pleuræ, limb of abdomen, and the legs black; on the under surface of all the thighs, near their base, is a fulvous spot.

Collection of Mr. Bates; also in my own cabinet.

Uroplata pectoralis, n. sp.

U. late oblonga, postice ampliata, subdepressa, obscure flava, subnitida; antennis obscure fulvo-piceis; pectore, tibiarum apice tarsisque nigro-piceis: elytris obsolete fusco maculatis, humeris modice lateraliter productis apice subacutis, apice obtuse rotundatis, fortiter serratis, angulo postico in laminam compressam bispinosam modice lateraliter productis; utroque prope suturam bicostato, interspatiis rude et profunde biseriatim punctatis; disco exteriore profunde confuse punctato, interstitiis elevato-reticulatis. Long. 3 lin.

Hab. Brazil.

Head moderately produced between the eyes, vertex smooth, impressed with a deep longitudinal groove; antennæ equal in length to the head and thorax, subincrassate, two basal joints slightly thickened, third slightly elongate, fourth and fifth gradually decreasing in length, the sixth scarcely half the length of the fifth, the seventh nearly equal to the third, somewhat thickened, and, together with the four following joints (which are closely united, but have their sutural lines distinctly visible under a lens), forming a narrow club; apical joints acute. Thorax nearly twice as broad at the base as long, sides narrowly margined, crenulate, nearly straight at the base, narrowed and rounded in front; upper surface transversely impressed on the hinder disk, transversely excavated on the basal lobe, the latter broadly truncate, stained on either side with a piceous spot; middle of disk in front nearly impunctate, finely strigose, sides coarsely and deeply rugose-punctate. Scutellum large, triangular, broad at the base, its apex truncate. Elytra much broader at their base than the thorax; humeral callus thickened, not raised above the surface of the elytra, but produced horizontally, its apex subacute, not extending beyond the lateral border. Apex of tibiæ thickened.

Uroplata Stålei, n. sp.

U. subelongata, subcuneiformis, subdepressa, rufo-fulva; capite supra (plaga verticali excepta) thoracisque margine laterali nigris: elytris apice obtusis, angulo postico vix prominulo, apice rotundato;

obscure metallico-viridibus, utroque tricostato, maculis duabus inter se confluentibus, una basi, altera vix ante medium positis, plagaque magna communi trigonata, ante apicem posita, fulvis.

Long. $3\frac{1}{2}$ lin.

Hab. Amazons.

Head very moderately produced between the eyes, vertex finely rugose, longitudinally grooved; antennæ shorter than half the body, subincrassate, two basal joints nearly equal, the first thickened, third nearly as long as the two preceding united; fourth and fifth equal, each two-thirds the length of the third; sixth distinctly shorter than the fifth, transverse; seventh rather shorter than the third, slightly thickened, and, together with the four apical joints, forming an indistinct, slightly compressed club; seven lower joints nearly cylindrical, subnitidous, granulose. Thorax more than one-half broader than long, sides nearly straight behind, rounded and narrowed before their middle, sinuate immediately behind the anterior angle, the latter armed with an obtuse tooth; above subcylindrical, flattened and transversely impressed on the hinder disk, closely covered with large round punctures, rugose-punctate on the sides, a small longitudinal space in the middle of the disk, impressed in the centre with a short longitudinal groove, free from punctures; basal lobe depressed, broadly truncate. Scutellum broadly triangular, rounded at the apex, basal surface oblique, apical horizontal, slightly concave. Elytra broader than the thorax, sides subparallel in front, gradually but slightly dilated towards the hinder angles, the angles themselves scarcely produced, obtuse; lateral and apical margins slightly dilated, the former minutely and remotely, the latter coarsely, serrate; each elytron tricostate, the interspaces deeply bigemellate-punctate.

Uroplata cruentata, n. sp.

U. elongata, anguste cuneiformis, subdepressa, fulvo-rufa, subnitida, thoracis vittis duabus nigris: elytris apice obtuse rotundatis, angulo postico non prominulo, obtuso; singulatim tricostatis, obscure rufo-violaceis, metallico-micantibus, utroque linea angusta suturali, margine laterali, postice abbreviata, fascia transversa subapicali maculisque tribus, harum prima basi, secunda vix ante medium, margini adfixa, tertiaque transversa, apice posita, fulvo-rufis.

Long. 3 lin.

Hab. Brazil.

Head moderately produced between the eyes, vertex obsoletely grooved longitudinally, indistinctly keeled in front; antennæ longer than the head and thorax, robust, subincrassate, two basal joints equal, scarcely thickened, third somewhat elongate,

fourth and fifth each nearly one-half shorter than the third, equal, sixth much shorter than the fifth, transverse, seventh equal in length to the third, somewhat thickened, and forming with the four terminal joints an elongated, scarcely compressed club; sutural lines between the four latter obsolete. Thorax nearly twice as broad as long at the base, sides straight but running slightly outwards from their base to the middle, thence rounded and narrowed to the apex; anterior angles armed with an obtuse tooth; above transversely convex, transversely depressed on the hinder disk, surface closely covered with large deep punctures, rugose, a longitudinal space down the middle nearly free from punctures; basal lobe depressed, very broadly truncate. Scutellum transverse at the base, sides narrowed from base to apex, the latter obtuse, surface oblique at the base, apical portion horizontal, transversely grooved. Elytra slightly increasing in width from base to apex, lateral and apical margins narrowly dilated, finely but not closely serrate; apical border obtuse, its serratures less distinct than those of the sides; each elytron tricostate, the interspaces deeply bigemellate-punctate; the three patches on each elytron are arranged as follows:—first subrotundate at the base; the second large, subtriangular, on the outer disk, its base attached to the lateral border; and the third transverse, concave, placed before the apex.

In my collection.

Uroplata octopustulata, n. sp.

U. elongata, anguste cuneiformis, subdepressa, rufo-testacea, subnitida; thorace lateribus rotundatis, rude rugoso-punctato: elytris apice truncatis, angulo postico lamina compressa, apice rotundata, lateraliter vix prominula, instructis; utroque tricostato, pone medium quadricostato; pallide rufo-violaceis, singulatim pustulis quatuor, una basi, secunda ante, tertia pone medium quartaque ante apicem positis, fulvis, angulo postico obscure purpureo.

Long. $3\frac{1}{4}$ lin.

Hab. Brazil.

Very similar in form and colouring to *U. cruentata*, but more coarsely punctured; apex of the elytra more distinctly truncate, their hinder angles more distinctly produced. Head somewhat strongly produced between the eyes, vertex smooth; antennæ robust, subincrassate towards their apex, joints cylindrical, two basal equal, only slightly thickened, third slightly elongate, fourth and fifth equal, each one-third shorter than the third, sixth rather shorter than the fifth, seventh equal in length to the third, slightly thickened, and, with the four following joints (which are coalescent, and without any trace of sutural lines), forming an indistinct club, the apex of which is acute. Thorax

nearly twice as broad as long at the base, flattened on the hinder disk, subcylindrical in front; surface deeply and closely impressed with large punctures, rugose. Scutellum semiovate. Elytra broader at the base than the thorax, gradually but slightly increasing from their base to the hinder angles; shoulders oblique; lateral and apical margins narrowly dilated, coarsely serrate; interspaces between the costæ deeply and coarsely bigemellate-punctate; on the outer disk, just above the commencement of the third vitta, the puncturing is somewhat confused.

In my own cabinet.

Uroplata concava, n. sp.

U. elongata, subparallela, subdepressa, obscure rufo-fusca, subnitida; thoracis vittis duabus nigro-fuscis; pedibus flavo-fulvis: elytris fere parallelis, apice conjunctim concavis, serratis, angulo postico in laminam acutam, trigonam, postice serratam, extrorsum vix dilatatam, retrorsum paullo productis; utroque tricostato, interspatiis profunde bifariam punctatis, interspatio tertio pone medium confuse punctato.

Long. $3\frac{1}{2}$ lin.

Hab. Amazons.

Head strongly produced between the eyes, vertex subopake, slightly concave behind, furnished with a longitudinal ridge in front; antennæ very robust, incrassate, two basal joints short, almost transverse, thickened, nearly equal, four following joints short, cylindrical, transverse, nearly equal, the sixth being scarcely perceptibly shorter than the fifth; seventh nearly as long as the two preceding united, coalescent with the four terminal joints, which together form an opake compressed club, dilated at its upper edge, their sutural lines visible under a lens. Thorax about one-half broader than long at the base, sides moderately narrowed and rounded from base to apex, anterior angles armed with an obtuse tooth; above subcylindrical, flattened and transversely depressed on the hinder disk, surface closely covered with coarse deeply impressed punctures, sides rugose; basal lobe oblique, broadly truncate, not transversely grooved. Scutellum transverse, sides diverging from the base towards the apex, the latter obtusely truncate. Elytra broader than the thorax, subparallel, scarcely increasing in width near the hinder angles; sides very narrowly margined, their outer edge finely serrate, suture (more particularly in front) strongly costate. Thighs armed with a short tooth beneath.

Collection of Mr. H. W. Bates and my own.

Uroplata cincta, n. sp.

U. elongata, ad apicem vix ampliata, subdepressa, obscure fulva,

subnitida; pedibus flavo-fulvis, vertice, antennis thoracisque vittis tribus nigris; elytris (basi excepta) obscure æneo limbatis, limbo laterali bisinuato: elytris apice truncatis, subfortiter serratis, angulo postico in laminam compressam, apice acutam, postice serratam, lateraliter modice prominulam productis; utroque tricostato, interspatiis profunde bifariam punctatis, interspatio tertio pone medium confuse trifariam punctato.

Long. $3\frac{1}{2}$–4 lin.

Hab. Amazons. Collected by Mr. Bates.

Head strongly produced between the eyes, vertex smooth, indistinctly impressed with a longitudinal groove; antennæ very robust, not increasing in thickness towards their apex, the latter acute; basal joint thickened, second to the sixth inclusive short, nearly equal in length, the sixth being scarcely shorter than the fifth, obturbinate, seventh nearly equal in length to the fifth and sixth, and, together with the four apical joints, opake and not stouter than those preceding; sutural lines between the last four entirely obsolete. Thorax not twice as broad as long, sides straight at the base, rounded and narrowed in the middle, sinuate in front, lateral margin obsoletely denticulate; above subcylindrical, flattened and excavated transversely on the hinder disk; surface impressed with large, round, deep punctures, which are crowded on the sides, more distant on the disk; a broad lateral vitta on either side, and a narrow stripe down the centre, black; basal lobe broadly truncate, its surface oblique, transversely grooved. Scutellum pentagonal, its basal half oblique, the apical surface horizontal. Elytra broader than the thorax, nearly parallel, slightly increasing in width towards the hinder angles, sides narrowly margined, finely toothed, hinder angles produced into a broad triangular process, which, slightly dilated laterally, does not reach backwards beyond the apical margin, its posterior edge armed with three or four large teeth; apical margin of elytra furnished with coarser teeth than those on the sides. All the thighs armed beneath with an acute tooth.

Uroplata Robinsonii, n. sp.

U. elongata, subdepressa, rufo-fulva; pedibus flavis; antennis, thoracis lateribus elytrorumque margine rufo-fuscis: elytris apice truncatis, angulo postico in spinam validam acutam retrorsum productis, utroque tricostato, puncto centrali anguloque postico nigris.

Long. $2\frac{2}{3}$ lin.

Hab. Brazil.

Head strongly produced between the eyes, vertex furnished with a longitudinal ridge in front, obsoletely grooved posteriorly; antennæ robust, subincrassate, scarcely longer than the head and

thorax, two basal joints short, nearly equal, slightly thickened, third scarcely longer than the second, semiovate, its apex truncate; three following joints very short, transverse, nearly equal, the sixth being scarcely shorter than the fifth; these joints (from the first to the sixth) are all covered with coarse longitudinal sulci; seventh nearly equal to the two preceding united, somewhat thickened, and, together with the four terminal joints, forming a distinct, very slightly compressed club, the sutural lines between the last four obsolete. Thorax scarcely broader at the base than long, subconic; sides nearly straight at their extreme base, thence obliquely narrowed to the apex; basal margin deeply sinuate on either side, medial lobe broadly truncate, its surface oblique, transversely sulcate. Scutellum trigonate, its apex obtusely truncate. Elytra broader than the thorax, nearly parallel in front, slightly dilated towards the hinder angles, the latter armed with a strong acute black spine, the apex of which is produced almost directly backwards; lateral and apical margins narrowly dilated, coarsely serrate; each elytron strongly tricostate, the edge of the third costa serrate.

In my own cabinet.

Uroplata miniata, n. sp.

U. anguste cuneiformis, depressa, fulva; antennis, thorace vitta utrinque, elytrorumque fascia subapicali, margine laterali vittulisque obliquis duabus sanguineis: elytris singulatim tricostatis, humeris elevatis, apice obtuse truncatis; angulo postico in spinam acutam purpuream oblique productis.

Long. 3 lin.

Hab. Venezuela.

Head strongly produced between the eyes, vertex slightly raised, impressed in the middle with a longitudinal groove; antennæ nearly half the length of the body, robust, subincrassate; basal joint thickened, second and third each shorter than the first, equal, the second being slightly thickened; fourth and two following joints very short, transverse, equal, the sixth being scarcely sensibly shorter than the fifth, seventh equal in length to the two preceding, and, together with the four apical joints, thickened and forming an elongate slightly compressed club; sutural lines between the last four joints nearly obsolete. Thorax as long as broad at the base, subconic, the sides obliquely converging from immediately above the base to the apex; subcylindrical above, indistinctly flattened on the hinder disk, closely and deeply impressed with large round punctures; basal lobe oblique, its surface transversely sulcate. Scutellum large, depressed at the base, subpentagonal, the apical angle very obtuse. Elytra broader than the thorax, subparallel, slightly dilated to-

wards the hinder angles, the latter armed with a broad, flattened, slightly curved, oblique spine, its upper surface thickened, its apex directed backwards; the narrow lateral border, together with the apical margin, serrate; humeral callus obliquely elevated, its apex acute; each elytron with three strongly raised costæ, the first still more strongly elevated at the base, the second and third both commencing at the apex of the humeral callus, the outer one serrate; interspaces deeply bigemellate-punctate; the two oblique vittæ extend from the lateral margin nearly to the suture, the first running along the hinder edge of the raised humeral callus, the second being placed just below the middle of the disk.

In my own collection.

[To be continued.]

XXXVIII.—*Notes on the Whalebone-Whales; with a Synopsis of the Species.* By Dr. John Edward Gray, F.R.S. &c.

The rarity of their occurrence, the difficulty of naturalists examining them when they do occur, and especially of comparing them with other specimens, explain why the Whalebone-Whales have been so imperfectly known; and, when observed, the specimens are so large that it is almost impossible for the eye of the naturalist to take them in as a whole, and to compare the parts in detail.

The allied species are so alike externally, that naturalists and others who have had the opportunity of examining them have been inclined to regard the different specimens observed as only states of growth of the same species; and, for the same reason, the specimens which have been observed in different parts of the world have been regarded as alike; and thus the belief has become general that the species of Whalebone-Whales have a very extended geographical distribution.

The examination and comparison of the few skeletons that have been collected have shown that there are many more species than has been generally supposed, and seem to lead to the conclusion that each species of Whalebone-Whale has only a comparatively limited geographical range; and the observation of whales seems to make it probable that some of them make periodical migrations within these limits.

The study of the subject, and especially of the bones that have been collected, has led me to the following conclusions:—

1. That, though the adult Whalebone-Whales have a large head compared with the size of the body, the head of the fœtal

specimen is short, and that it increases in size, and especially in length, much more rapidly than the rest of the body. This is very apparent in the Right or Greenland Whale, where the head of the adult is two-fifths, while that of the new-born is only two-sevenths, of the entire length of the animal. These differences are shown by Eschricht in his figures. The head of the new-born and of the adult Cape Whalebone-Whale show the same difference; but the head in both states is smaller, compared with the entire length of the animal, than in the northern or Greenland species.

2. That the bones of the Whalebone-Whales in the very young state are the same in number, and nearly the same in form, as in the adult animal, the bones only becoming more or less completely ossified, which they appear to do very slowly, and in some species even more slowly than in others; so that the notion that the number of vertebræ increases with the growth of the animal, which has been entertained by some naturalists, is a mistake.

3. It also appears that certain parts which become ossified in most kinds of Whalebone-Whales do not become so in others. Thus the lateral processes of the cervical vertebræ of *Megaptera*, *Benedenia*, and *Physalus* seem to be nearly of the same form in the young and cartilaginous state; that is to say, they have the usual form of these bones in the *Balenopteridæ*; and though the entire lateral process becomes ossified in *Physalus* and *Sibbaldus*, the end of the process remains cartilaginous at least to a much greater age, if not always, in the genera *Megaptera* and *Benedenia*. Naturalists observing this apparently imperfect development of the bones in the latter genus, have been induced to believe that it arose from the youth of the specimens observed, instead of being a peculiarity of the genera, overlooking the fact that the skeletons of the oldest *Megapteræ* that have been examined show the same apparently imperfect development and truncated form of the bones.

4. The general form of the baleen, the comparative thickness of the enamel, and the fineness or coarseness of the internal fibres which form the marginal fringe, and the internal structure as shown by the microscope, all present good characters for determining the species and for separating the Whalebone-Whales into natural groups, as I have shown in the 'Zoology of the Erebus and Terror.'

The qualities of the whalebone or baleen from various localities, and hence from different kinds of Whales, have been observed, and have led to their employment for different purposes by the handicraftsman; according to their goodness and rarity, they fetch very different prices in the market—an instance of

the practical workingman and the trader being in advance of the scientific zoologist.

5. The difference in form of the tympanic bones is great, and affords good characters, not only to separate the species from one another, but also to group them into families and genera.

6. The fact that some Whalebone-Whales have the first rib furnished with a double head, one head attached to the last cervical and the other to the first dorsal vertebra, which had been observed by Rudolphi, Yarrell, Dubar, and Schlegel, though apparently considered as only to be found in the young state of the species by the latter author, disappearing as the animal increases in age, proves, I believe, to be a permanent peculiarity of considerable importance, and justifies Lilljeborg in using it as a character for the discrimination of the species, and even for separating the Whales into groups or genera. That it is not a peculiarity of the young state is proved by its being seen well developed in the skeleton of the gigantic Ostend Whale, which was formerly exhibited at Charing Cross and in other places. This peculiarity is found both in the Right Whales and in the Finners.

Indeed, when the skeletons of the specimens from different localities can be examined, there are no want of characters to separate the Whales into genera and species—as, for example, the breadth of the upper jaw, the size and form of the ramus of the lower jaw, the form of the lateral processes of the cervical vertebræ, the number of the dorsal and caudal vertebræ, the form and size of the articulating surfaces of the vertebræ, the form and number of the ribs, the form of the os hyoides and of the sternum, the shape of the scapula and the development or non-development of the coracoid process, the form and proportions of the bones of the arm, and the number and comparative length of the bones of the paddle. I am convinced that, when more skeletons have been collected, the number of the species of these animals will be greatly increased, especially if the bones of the skeletons are kept separate, and not set up, so that the bones of the different species can be accurately compared. For it is to be observed, probably from the eye not being able to take in the peculiarities of so large a subject, that some of the best comparative anatomists have regarded skeletons from very different localities, as the *Megapteræ* from the Northern Seas and from the Cape, as the same species, from a comparison of set-up skeletons, which were at once declared to be distinct when the separate bones were compared in detail.

The Whalebone-Whales (*Mysticete*) are characterized by having only very rudimentary teeth, that never cut the gum, and by having cross rows of flexible horny plates, fringed on the inner

edge, on each side of the palate. The tympanic bones are large, conch-like, attached to the expanded periotic bones, which are articulated to the skull. The lachrymal and malar bones are small and thin, and are often lost in preparing the skulls.

The Whalebone-Whales may be divided into two families, thus:—

Fam. 1. **Balænidæ.** (The Right Whales.)

The belly smooth, without any longitudinal folds. Dorsal fin none; pectoral fin broad, truncated at the end. Maxillary bones narrow. Baleen elongate, slender, straight. Tympanic bones rhombic. Scapula higher than wide.

A. *Head very large; of adult, two-fifths the entire length. Baleen elongate, slender, with a single series of very fine elongate central fibres, forming a fine flaccid fringe. Enamel thick, polished.*

1. Balæna.

Ribs 13; the first like the others, single-headed; the tympanic bone rhombic, aperture oblong, only slightly contracted at the upper end, and about two-thirds the length of the bone. (Proc. Zool. Soc. 1864, p. 201, f. 1.)

1. *Balæna mysticetus,* Cuvier, Oss. Foss. v. t. 25. f. 9, 10 (adult). (Greenland Right Whale.)

Balæna mysticetus arctica, Schlegel, Abh. 36.
Nordhval, Eschr.

Hab. Northern Sea, Greenland.

2. *Balæna Biscayensis,* Eschr. & Van Ben.

Hab. The Bay of Biscay. I have seen no remains of this Whale.

3. *Balæna marginata,* Gray, Zool. Ereb. & Ter. 48, 61. f. 1.

Only known from some plates of baleen received from Western Australia. This is undoubtedly a very distinct species. The baleen is of nearly the same structure as that of the Greenland Whale; but we do not know what may be the form of the first ribs or of the bones of the other parts of the skeleton.

B. *Head large; of adult, about one-fourth the entire length. Baleen elongate, broad at the base, with several series of rigid central fibres, forming a rigid fringe. Enamel thin.*

2. Eubalæna, Gray, Proc. Zool. Soc. 1864.

Ribs 15; the first like the others, single-headed. Tympanic

bones rhombic, nearly like those of *Balæna*. Head large; of adult, about one-fourth the entire length. Vertebræ 52.

E. australis, Gray, Proc. Zool. Soc. 1864.

Balæna australis, Cuvier, Oss. Foss. t. 25. f. 1, 2 (young), f. 5, 6 (adult).

Hab. South Sea, Cape of Good Hope. Two skeletons, Mus. Paris.

I believe that the baleen or whalebone which is sold in the market as South-Sea whalebone comes from this Whale.

3. Hunterus.

Ribs 15; the first double-headed, the rest single-headed. Tympanic bones rhombic, nearly like those of *Balæna*. Head large, forming above one-fourth of the entire length of the adult.

Hunterus Temminckii.

Balæna mysticetus australis, Schlegel, Abhandl. 37.

Hab. South Sea, Cape of Good Hope (Horstock). Skeleton of young, Mus. Leyden.

Temminck and Schlegel, in the 'Fauna Japonica,' t. 28 & 29, figure a Whale from Japan (from a model made in porcelain-clay by a Japanese) under the name of *B. australis*; but no remains of it have been as yet sent to Europe; so that we do not know whether it is an *Eubalæna* or a *Hunterus*, or if it may not be an entirely new form. The baleen sold in the market as "North-west-coast whalebone," which I figured in the 'Zoology of the Erebus and Terror,' t. 1. f. 4, is quite distinct, and fetches a different price, from that called "South-Sea whalebone," which is said sometimes to be brought from the Cape—showing that the Whalebone-Whale of the North Pacific is a distinct species. I called it *Balæna Japonica* in my monograph; but Lacépède had already given that name to a Whale described from a Japanese drawing, which is differently coloured from the one figured by Temminck: therefore I now propose to call it *Balæna Sieboldii*.

4. Caperea, Gray, Proc. Zool. Soc. 1864, p. 202.

The first rib ——? The tympanic bone irregular rhombic, aperture irregular, much contracted at the upper end, and the wide part not half the length of the bone. (Proc. Zool. Soc. 1864, p. 203, f. 2.)

1. *Caperea antipodarum*, Gray, Proc. Zool. Soc. 1864, p. 202.

Balæna antipodarum, Gray, Dieffenbach, N. Zealand, t. 1.

Hab. New Zealand; Otago.

Fam. 2. **Balænopteridæ.** (The Finners.)

Belly longitudinally plaited. Dorsal fin distinct; pectoral fin lanceolate. Maxillary bones expanded. The baleen short, broad, triangular, twisted. The tympanic bones oblong ovate. Scapula broader than high.

A. *The Hunchbacked Whales have a very low broad dorsal, a very long pectoral fin; arm-bones strong, broad; fingers very long, joints* 3 *to* 10; *the cervical vertebræ are often anchylosed; the neural canal high, triangular, with angles rounded, as high as broad.*

1. MEGAPTERA.

The pectoral fin about one-fifth of the entire length of the animal. The second cervical vertebra with two short, truncated, subequal lateral processes. Ribs 14; first single-headed. Vertebræ 54 or 55.

a. *Blade-bones without any acromion or coracoid process; the bodies of the cervical vertebræ subcircular; arm-bones broad.* (Megaptera.)

1. *Megaptera longimana*, Gray.

Balæna longimana, Rudolphi.

Hab. North Sea. Skeletons in British Museum and Liverpool.

b. *Blade-bone with a small coracoid process; the bodies of the cervical vertebræ nearly square, with the angles rounded.* (Pœscopia.)

2. *Megaptera Lalandii*, Gray, Proc. Zool. Soc. 1864, p. 207.

Balæna Lalandii, Fischer.
Balæna Pœscop, Desmoul.

Hab. Cape of Good Hope. Skeleton, Mus. Paris; cervical vertebræ, Brit. Mus.

c. *Blade-bone with a distinct acromion and coracoid process; arm-bones more slender; fingers* —— ? (Eschrichtius).

3. *Megaptera ? robusta.*

Balænoptera robusta, Lilljeborg, Fördrag, Kjöbenh. 1860, p. 602. fig. 1; Scand. Hvaldjur. p. 77.

The coronoid process of the lower jaw low, but little developed. Ribs 15 . 15, the first three with a small compressed process below the condyle. Vertebræ 60; the lateral processes of the hinder cervical vertebræ free at the end, the lower ones longest, bent up and dilated at the end.

Hab. Northern Sea.

The skeleton was found buried in the sand, in an imperfect condition. The form of the dorsal and pectoral fins, and many of the more characteristic bones, as the second cervical vertebra, are not known.

I have been induced to refer it to this genus on account of the high, triangular, roundish form of the canal of the spinal marrow of the cervical vertebræ, and the form of the lower jaw. Lilljeborg referred it to *Balænoptera* on account of the form of the blade-bone; but the two species of *Megaptera* differ in the form of that bone. The rib, as well as the blade-bone, is more like that of *Physalus* than *Megaptera*; but I believe that it may be a genus distinct from both. These observations are founded on some drawings of the bones kindly sent to me by Professor Lilljeborg.

4. *Megaptera Novæ-Zelandiæ*, Gray, Proc. Zool. Soc. 1864, p. 207, f. 4 (ear-bones).

Hab. New Zealand. Ear-bones in British Museum.

There are, no doubt, other species of this genus,—as the Bermuda Humpback (*Megaptera americana*), described by Dudley, Phil. Trans. xxxiii. 258; and the Japanese Humpback, or Kugira (*Megaptera Kugira*), figured by Temminck in the 'Fauna Japonica,' from a drawing brought home by Siebold, under the name of *Balænoptera antarctica*, t. 30 (not t. 23).

Mitchell, the traveller in Australia, mentions a Humpback Whale inhabiting Portland Bay, Australia Felix; and others have been mentioned as inhabiting Terra del Fuego, Staten Land, by Cook, and Kamtschatka and Behring's Strait by Pallas.

B. *The true Finners have a high, erect, compressed, falcate dorsal fin, a moderate-sized pectoral fin, with stout arm-bones and short fingers, joints* 4 *to* 7*; and the neural canal of the cervical vertebræ is broad and low.*

a. *The dorsal fin is about three-fourths the entire length from the snout; and the cervical vertebræ are not anchylosed together. The neural canal oblong, transverse. Ribs* 14 *to* 16.

2. Benedenia.

The second cervical vertebra with two short lateral processes. Ribs 15; first single-headed, with a compressed internal process. The ramus of the lower jaw is moderate; lower jaw-bones thick, convex on the side. Vertebræ 60.

Benedenia Knoxii, Gray, Proc. Zool. Soc. 1864, 209.

Coronoid process of the lower jaw low and broad.

Hab. Coast of Wales; Northern Seas. Skeleton, Brit. Mus.

Mr. Flower has shown me the drawing of a skeleton of what appears to be a second North-Sea species of this genus, which has a well-developed ramus to the lower jaw.

3. Physalus.

The second cervical vertebra with a broad expanded lateral process, with a large perforation in the upper part of its base. The first rib with a simple compressed head, and with a compressed internal process near the condyle. Lower jaw-bones thick, convex on the sides, with a distinct conical coronoid process. Ribs 14 to 16. Vertebræ 60 or 62.

1. *Physalus antiquorum*, Gray, Proc. Zool. Soc. 1864.

The lateral processes of the 3rd, 4th, 5th, and 6th cervical vertebræ broad, ring-like; the lateral processes of the 2nd cervical elongate, oblique, truncated. Ribs 14 . 14.

Hab. Northern Seas. Skeleton, Mus. Brit. and Alexandra Park.

2. *Physalus Duguidii*, Gray, Proc. Zool. Soc. 1864.

Ribs 15 . 15.

Hab. Northern Seas; Orkney. Cervical vertebræ, Mus. Brit.

3. *Physalus Sibbaldii*, Gray, Proc. Zool. Soc. 1864.

Ribs 16 . 16. Ramus of lower jaw conical, high.

Hab. North Sea; mouth of the Humber. Skeleton in Hull Museum.

4. Sibbaldus.

The second cervical vertebra with a broad elongated lateral process, perforated at the base. The first and second ribs double-headed. Lower jaw-bones compressed, high, flat on the sides, with a distinct conical coronoid process. Vertebræ 55. Ribs 13 or 14. Arm-bones slender.

1. *Sibbaldus laticeps*, Gray, Proc. Zool. Soc. 1864.

Balænoptera laticeps, Gray; Lilljeborg, *l. c.* p. 63.

Ribs 13 . 13. Dorsal fin compressed.

Hab. Northern Seas. Skeleton, Mus. Berlin.

2. *Sibbaldus Schlegelii.*

Balænoptera from Java, Schlegel, Mus. Leyden.
B. Schlegelii, Flower, MS.
"*Megaptera* from Java," Van Beneden, Gray, Proc. Zool. Soc. 1864, p. 208.

Hab. Java. Skeleton, Mus. Leyden (young); skull, Mus. Leyden.

3. *Sibbaldus borealis*, Gray, Proc. Zool. Soc. 1864.

Balænoptera gigas, Reinhardt & Lilljeborg.

Ribs 14 . 14. Dorsal fin small, far back, on a prominence.

Hab. Northern Seas. Skeleton.

b. *The dorsal fin two-thirds of the entire length of the animal from the nose. Cervical vertebræ sometimes anchylosed. Neural canal trigonal, broader than high. Ribs* 11.

5. Balænoptera.

The second cervical vertebra with a broad, long lateral process, perforated at the base. The first rib single-headed. The lower jawbone moderate, with a distinct, high, conical coronoid process. Vertebræ 50. Ribs 11. Arm-bones slender.

Balænoptera rostrata. (The Little Beaked Whale.)

Hab. Common at the mouths of large rivers.

The "Finner Whales" are mentioned as inhabiting almost all the seas; and doubtless there are a large number of species that have not yet been brought under the notice of zoologists, or of which there are no remains in any European museum.

XXXIX.—*On New Mammalia from the Red Crag.* By E. Ray Lankester.

[Plate VIII.]

During a recent visit to Suffolk I had the pleasure of examining a very fine collection of Crag fossils in the possession of W. Whincopp, Esq., of Woodbridge, perhaps one of the most remarkable and interesting collections ever formed from a single deposit, containing as it does remains derived from every stratum from the Greensand upwards, and illustrating in a very striking manner the fallacy of hasty generalizations founded upon the more or less extended distribution of genera or species through any given series of deposits. Though I would by no means wish to impugn the doctrine of strata identified by their organic contents, yet I feel confident that too great caution cannot be exercised in drawing conclusions from the phenomena of *association* when contemporaneity is not demonstrable. In the Red Crag we have derivatives and representatives of nine different faunæ, to some one of which it becomes necessary to refer any new or undescribed fossil that may be discovered therein. There are—(1) Upper Greensand fossils in considerable numbers, portions of Ammonites, Terebratulæ, Saurian teeth and bones, &c. (2) Chalk fossils, represented by flints containing Sponges and Echinoderms. (3) Fossils from the lowest Eocene beds, the Thanet Sands. (4) Nodules, the so-called "coprolites," and very numerous remains of Fish, Crustacea, and (much more rarely) Reptilia and Mammalia, derived from the London Clay. (5) Teeth of *Carcharodon heterodon* and portions of *Edaphodon*,

from Middle Eocene beds. (6) Teeth of *Mastodon angustidens, Rhinoceros Schleiermacheri, Tapirus priscus*, and others, derived from the breaking up of a Miocene deposit of the same age as the Epplesheim strata. Remains of *Mastodon* have been found at the base of the *Coralline* Crag, in a débris formed of phosphatic nodules and vertebrate remains. (7) Cetacean remains, consisting of bones and teeth, much worn, teeth of *Carcharodon megalodon* and *Oxyrhina*, also worn, derived from a previous Pliocene deposit, contemporaneous with the Middle Crag of Antwerp, where these same Cetacean remains and Sharks' teeth are abundant in an *unworn* state. These also have been found at the base of the Coralline Crag. (8) Shells derived from the Coralline Crag—*Pectunculus glycimeris, Pyrula reticulata*, &c. (9) The proper fauna of the Red Crag, certain Fish-remains, Mollusca, Crustacea, and perhaps some Mammalia.

It seems very certain that the majority of the terrestrial Mammalia obtained from the Red Crag have not only a Miocene facies, but are absolutely derived from a Miocene deposit, whilst the Cetacea are of a later period. In the equivalent of the Red and Coralline Crags at Antwerp not a single terrestrial mammal has been found; but Cetacean remains are abundant, and the teeth of a species of *Phoca* have been detected. The beds at Antwerp give indications of having been deposited far out at sea, in a much quieter manner than the Red Crag, which appears to have been a littoral deposit, and is in fact a raised beach, in forming which great districts of previous strata were broken up by the sea, which has now destroyed the greater part of the Red Crag in its turn. It is therefore not impossible that, in the process of the formation of the Red Crag, remains of certain terrestrial mammals then living on the shores of its sea should have been imbedded; whilst in the Antwerp strata, more distant from the coast, the remains of none but marine beings could be enveloped. No Mammalia have, however, yet been found of which it could be said with any degree of certainty that they lived contemporaneously with the Molluscan fauna of the Crag; and we may be confident, from the position in which they have been found, from their condition and palæontological affinities, that *Mastodon angustidens, Rhinoceros Schleiermacheri, Tapirus priscus, Felis pardoides*, and other Miocene forms, did not live during the deposition of the Red or Coralline Crags.

In looking over Mr. Whincopp's collection, I found some Mammalian teeth which have not hitherto been noticed, a description of which I trust may prove of some value as an addition to our knowledge of the fauna of the Red Crag and of the British fossil Mammalia generally.

Castor veterior, n. sp.

Two molar teeth, one of which is represented in Pl. VIII. fig. 5, and an incisor of the lower jaw, in fig. 6, belong to Mr. Whincopp's collection. They were obtained from a Red-Crag pit in the neighbourhood of Sutton, and are in the usual mineralized condition of Red-Crag Mammalian remains, being very heavy and presenting an iron-stained glossy surface; so that any person with a moderate experience in these matters would at once recognize their origin. They unmistakeably belong to a species of Beaver. The molar figured I have carefully compared, with the assistance of Mr. Davies, with the skulls of *Castor Europæus* from the Lincolnshire fens, in the British Museum, as also with teeth from Grays, and a specimen in my own collection of the Canadian Beaver. I find that it is the premolar of the upper jaw of the left side, the dental formula of the Beaver, as given by Prof. Owen, being $i.\ \frac{2}{2}$, $pm.\ \frac{1-1}{1-1}$, $m.\ \frac{3-3}{3-3} = 20$. It differs chiefly from the specimens I have examined in the great length of the fang, and also in the arrangement of the folds of enamel on the crown or flat grinding-surface. This resembles that of the *Castor Canadensis* rather than that of the *C. Europæus*, but differs from it in the greater width of the fossæ of dentine between the enamel ridges, and in the greater inward development of the large anterior fold or lobe. In *C. Europæus* the premolar of the upper jaw presents the same general arrangement of the enamel ridges; but certain minor variations may be detected which do not exist in the Crag or Canadian species. These relate merely to the proportion and development of certain folds, and are probably of little value as specific characters. I do not, however, hesitate to consider the Beaver to which the teeth under description belonged as a distinct species. Fossil Beavers have been met with at Perrier and in the Val d'Arno, the latter being a Miocene, the former a Pliocene deposit. The Crag form does not resemble either of these, and I therefore distinguish it as *Castor veterior*. The *C. Europæus* has been met with in a fossil condition at Grays in Essex, and at Ilford, associated with the remains of *Elephas antiquus*, *Rhinoceros tichorhinus*, &c. The *Trogontherium Cuvieri* has a tooth very differently marked from that figured, the age of which would otherwise have induced one to compare the two.

There is little doubt that the Beaver, like all the terrestrial Mammalia found in the Crag which are known (with perhaps one or two exceptions), was derived from a previous Miocene deposit.

I should mention that the incisor tooth, which is imperfect, presents no very striking characters, but is of a very rich black

colour, partly owing, no doubt, to the natural stain which occurs in the incisors of most Rodentia.

Delphinus (*Phocæna*) *uncidens*, n. sp.

Of the two little teeth represented in Pl. VIII. figs. 12, 13, one is in my own collection, the other in that of Mr. Whincopp. When first I obtained these, I was led, by their peculiar curved form and great length of fang, to regard them as incisors of a species of *Phoca*, and this the more especially since a Seal had been discovered by the illustrious Van Beneden in the Antwerp Crag. A careful comparison and examination of the teeth, however, has convinced me that they belong to a species of *Delphinus* hitherto undescribed. In those Seals which present incisors having this peculiar hook-like form the tooth is invariably lobed or developed to a small extent on one side; the fang, too, is considerably flattened, so that the antero-posterior breadth is greater than the lateral. In the two teeth from the Crag this is not the case: the unciform crown is perfectly symmetrical, and the fang is flattened in the reverse direction. The form of the teeth agrees very exactly with the conoid denticles of some Delphinidæ, more particularly of the subgenus *Phocæna*. The enamel on the crown is thin, as in most Cetacea, whilst the enlarged fang is very characteristic of that group. I propose therefore to call this species *Delphinus uncidens*. With the teeth I would associate, under this specific name, certain small cetotolites, which have long been known as occurring in the Crag, more particularly in the neighbourhood of Woodbridge (whence also the teeth were originally obtained), but which have never been described. One of these auditory bones is represented in figs. 2, 3. Such examples are very numerous of this size, which would agree very well with the size of the small teeth. They are evidently the "ear-cases" of small Delphinidæ, and present no striking characters which should distinguish the animal to which they belonged from the ordinary forms of *Phocæna* and *Delphinus*. It may be considered a very fortunate circumstance that the teeth and ear-bones can thus be united, and assigned to the same species in so certain a manner, since the disconnected nature of the Cetacean remains of the Red Crag has in many instances prevented a correct appreciation of their specific and generic value.

Delphinus (*Phocæna*) *orcoides*, n. sp.

The species to which I have ventured to give this name is represented by three teeth in the collection of Mr. Whincopp, of which two are drawn in Pl. VIII. figs. 14–18. At first sight, the tooth in figs. 14, 15, 16 might also be mistaken for the canine of one of

the Pinnigrada; but a more accurate examination demonstrates its true nature. The crown of the tooth is conical, but not so curved as that of the preceding species, whilst the fang is broad and twisted, an occurrence which is very frequent in the Grampus and larger Dolphins. The enamel is thin, and, in one specimen, has been worn away so as to form a flat surface. This mode of attrition is frequently observable in specimens of *Phocæna Orca* and *P. Capensis*; and, indeed, in form and size these teeth agree so well with those of the former species, that I have adopted the specific term *orcoides*. The base of the fang in the specimen drawn in figs. 14, 15, 16 exhibits a structure to which I am anxious to direct attention, as being characteristic of fossil Cetacean teeth. The cement exists in undulating spiral layers surrounding the fang, forming slight ridges where the processes of mineralization have removed the more yielding matter. These spirals or circular ridges I have observed on the base of Cetacean teeth from Antwerp in the collection of M. Van Beneden; and a similar structure is to be observed in gigantic dental remains from both the Suffolk and Antwerp Crags, which have not yet been assigned to any group of animals. A section of the tooth of the *Phocæna orcoides* is afforded by two specimens, and will completely confirm the assumption of its Cetacean affinities. The lower part of the fang in one tooth is transversely fractured, and shows the osteo-dentine arranged in concentric layers, and filling up the central cavity, which is thus made solid throughout. The dentine and thickened cement are also seen in section. In another specimen, in which the crown is broken off from the fang, the cavity is still retained, running right into the conical cusp, but is small, and shows signs of thickening in the walls; the dentine does not occupy much extent, whilst the cement is very largely developed, and is covered by a most delicate layer of enamel. The teeth of the *Phocæna orcoides* are not unlike those of the *P. crassidens* described by Owen from the fens of Lincolnshire; but I am not aware of any reasons for supposing that they are specifically identical. I have seen two or three specimens of large petro-tympanic bones from the Crag, evidently belonging to a Grampus about the size of the one which possessed the teeth figured; and I therefore venture to associate them as belonging to the same species. I am not able here to give a figure of this larger cetotolite, but hope hereafter to do so.

It would be a very desirable thing to identify the tympanic bones described by Prof. Owen as *Balæna definita* &c. with other Cetacean remains; and I believe that much light will be thrown on this and the nature of the petro-tympanic bones, teeth, and vertebræ of the Crag Cetacea generally by instituting

a comparison between these and the fossil Cetacea of the Antwerp Crag, where specimens so much more perfect and intelligible are discovered. M. Van Beneden is at present, I believe, engaged in working out the generic and specific relations of the Cetacea of that locality.

Ursus Arvernensis, Croiz. & Job.

Professor Owen has already noticed the existence of a form of *Ursus* in the Red Crag, but has not assigned it to any particular species. The tooth figured in Pl. VIII. figs. 1 & 4 is from the collection of Mr. Whincopp, and was obtained, I believe, from a Crag-pit at Newbourn, near Woodbridge. I have very little doubt, after a careful comparison with a cast in the British Museum and De Blainville's beautiful figures, that it is the *Ursus Arvernensis* of Croizet and Jobert which has thus left the canine tooth of the left side of its upper jaw in the Red Crag of Suffolk. The tooth is remarkable for its small size, its flatness, narrowness, and length, and also for a furrowed appearance produced by slight ridges which run longitudinally down the side of the crown. The anterior margin of the tooth gives indication of a considerable amount of usage, being ground down to a perfectly smooth surface.

Hyæna antiqua, Lankester.

I am happy to be able to figure another specimen of a molar tooth belonging to this animal, a careful examination of which has fully convinced me of the accuracy of my former determination of its specific value. It is the second premolar tooth of the left ramus of the lower jaw, and presents the same large anteroposterior measurement and shallowness in the crown which characterized the former specimen. Although much worn, and on the inner side somewhat imperfect, the tooth affords sufficient evidence of these facts. The cingulum also is developed to that very moderate extent only which was observed in the tooth from the upper jaw, and was one of the most marked differences between the *Hyæna antiqua* and the Pleistocene *H. spelæa*. (See Pl. VIII. figs. 7, 8, and Ann. & Mag. Nat. Hist. January 1864, Pl. VIII.)

Canis primigenius, n. sp.

I have given this name, with a certain amount of reserve, to the possessor of the tooth drawn in fig. 11. It may perhaps hereafter be identified with more characteristic teeth, which will enable their discoverer to define the species better than I am at present able to do.

I here subjoin a list of all the species of Mammalia known to occur in the Red Crag.

TERRESTRIAL.

Ursus Arvernensis, *Croizet & Jobert.* (Occurs also at Auvergne, South France.)

Hyæna antiqua, *Lankester.*

Felis pardoides, *Owen.* (Similar species at Epplesheim : Miocene.)

Canis primigenius, *Lankester.*

Pterodon, sp., *Owen.*

Sus palæochœrus, *Kaup.* (Occurs at Epplesheim.)

Sus antiquus. (Ditto.)

Equus, sp., *Owen.*

Hipparion, sp., *Owen.* (Occurs at Epplesheim.)

Mastodon angustidens, *Owen.* (Ditto.)

Rhinoceros Schleiermacheri, *Kaup.* (Ditto.)

Tapirus priscus, *Kaup.* (Ditto.)

Cervus dicranoceros, *Kaup.* (Ditto.)

Megaceros, sp., *Owen.*

Castor veterior, *Lankester.*

Coryphodon, Hyracotherium, Palæotherium. (Derived from Eocene strata.)

MARINE *.

Balæna definita, *Owen.* (Occurs also in Middle Crag of Antwerp.)

—— emarginata, *Owen.* (Ditto.)

—— affinis, *Owen.* (Ditto.)

—— gibbosa, *Owen.* (Ditto.)

Balænodon physaloides, *Owen.* (Also at Antwerp.) [Several species, probably, are included under this name.]

Belemnoziphius declivis, *Owen.*

—— planus, *Owen.*

—— angustus, *Owen.*

—— angulatus, *Owen.*

—— undatus, *Owen.*

—— gibbus, *Owen.*

—— compressus, *Huxley.*

Choneziphius and *Belemnoziphius* occur also at Antwerp.

Delphinus (Phocæna) uncidens, *Lankester.*

—— —— orcoides, *Lankester.*

It will be observed, as a noticeable feature in these two lists, that the Mammalia in the former all have their analogues and representatives in Miocene † or early Pliocene strata, whilst those of the latter are met with elsewhere in later Pliocene strata. This, when taken into consideration with the worn and sea-rolled nature of the dental remains and with certain facts deducible from the study of the Mollusca of the Suffolk and Ant-

* This part of the list is necessarily very imperfect; but the author hopes soon to be able to enlarge and correct it considerably.

† The fragments of *Coryphodon*, &c., of course, form an exception to this.

werp Tertiary deposits, seems to warrant the assumption that there existed previously, along the Suffolk coast, a Miocene and a Pliocene deposit, the one abounding in terrestrial Mammalian remains, as the Epplesheim strata, the other in Cetacean fossils, as does the Middle Crag of Antwerp, and that the Red-Crag sea (and the Coralline also to a less extent) has entirely denuded and partially redeposited these strata in association with its proper Molluscan fauna, and perhaps with some Mammals, which, however, we are not able to designate.

Before concluding this paper (for the errors and defects of which I beg the reader's indulgence), I would wish to guard against the supposition that any of the Mammalia assigned to the Red Crag may have been obtained by mistake from the Mammaliferous Crag. That deposit is never, so far as I am aware, met with in superposition to the Red Crag; and the dental remains from it are light, absorbent, and unmineralized, as compared with those from the lower bed. Moreover the species are very widely different which occur in the two, the only common species being the *Mastodon angustidens*, which in both cases is certainly a derived fossil. The term "Mammaliferous" would doubtless be more appropriate to the Red Crag than it is to the much later Norfolk formation.

EXPLANATION OF PLATE VIII.

Figs. 1 & 4. Left upper canine of *Ursus Arvernensis*, Croizet & Jobert. Newbourn, Suffolk.
Figs. 2 & 3. Otic bones of *Delphinus uncidens*, Lankester. Woodbridge.
Fig. 5. Left upper premolar of *Castor veterior*, Lankester. Sutton, Suffolk.
Fig. 6. Incisor of the same. Suffolk.
Figs. 7 & 8. Left second premolar (lower jaw) of *Hyæna antiqua*, Lank. Felixstowe.
Fig. 9. Crown of premolar of *C. veterior*; enlarged.
Fig. 10. „ „ *C. Canadensis.*
Fig. 11. Canine of *Canis primigenius*, Lankester.
Figs. 12 & 13. Teeth of *Delphinus uncidens*, Lankester. Felixstowe.
Figs. 14, 15, 16. Tooth of *Phocæna orcoides*, Lankester. Near Sutton.
Figs. 17 & 18. Ditto. Ditto.

XL.—*Note on the Gibbon of Tenasserim,* Hylobates Lar. By Lieut-Col. S. R. Tickell, in a letter to A. Grote, Esq.*

I send a transcript from my Mammalian collection of what I had recorded of *Hylobates Lar*, at least of its wild and tame habits. Notes on its osteology, and soft anatomy, and structure you will not require, as you have a specimen by you, which I

* From the Journal of the Asiatic Society, No. II. (1864).

suppose, from what you say of its paralysis, will not live long. The one you have must have been about a year and a half old when I sent it you. Doubtless captivity has checked its growth. I give the dimensions taken of an adult one; but I think I have seen them larger, and the males are larger than the females (as in all monkeys).

The Burmese and Talaïns never keep Monkeys of any kind as pets. The Karens sometimes do. Of the Shans I cannot speak, but being Buddhists they probably do not either.

Hylobates Lar (Ogilby).

The *Hylobates Lar* is found in great abundance in all the forests skirting the hills which run from north to south through the province of Tenasserim. They ascend the hills themselves up to an elevation of 3000 to 3500 feet above the sea-level, but not higher, and are usually met with in parties of from eight to twenty, composed of individuals of all ages. It is rare to see a solitary one; occasionally, however, an old male will stay apart from the flock, perched on the summit of some vast tree, whence his howls are heard for miles around. The forests which these animals inhabit resound with their cries from sunrise to about 9 A.M., the sounds varying from the deep notes of the adult to the sharp treble of the young ones. During these vocal efforts they appear to resort to the extreme summits of the loftiest trees, and to call to each other from distant parts of the jungle. After 9 or 10 A.M. they become silent and are engaged feeding on fruit, young leaves, buds, shoots, and insects, for which they will occasionally come to the ground. When approached, if alone, they will sometimes sit close, doubled up in a thick tuft of foliage, or behind the fork of a tree near the top, so screened as to be quite safe from the shot of the sportsman. But indeed, when forced from its concealment and put to flight, the Gibbon is not easily shot. It swings from branch to branch with its long arms, shaking the boughs all around, flings itself from prodigious heights into denser foliage, and is quickly concealed from view by intervening trees.

If hit, there is no animal more tenacious of life, and its efforts when desperately wounded to cling to the branch and drag itself into some fork or nook where to hitch itself and die excite amusement and compassion.

The Gibbon (if we restrict that name to this species) is not nearly so light and active as its congener, *H. Hoolock* (the "Tooboung" of the Arakanese), which latter species is not liable to vary in colour, being always black, with the hands and feet concolorous, and the supercilia only white, instead of a circle of that colour all round the face. The Gibbon, moreover, walks

less readily on its hind legs than the Hoolock, having frequently to prop and urge itself along by its knuckles on the ground. In sitting it often rests on its elbows, and will lie readily on its back. Anger it shows by a fixed steady look, with the mouth held open and the lips occasionally retracted to show the canines, with which it can bite severely; but it more usually strikes with its long hands, which are at such times held dangling and shaken in a ridiculous manner, like a person who has suddenly burnt his fingers. It is, on the whole, a gentle peaceable animal, very timid, and so wild as not to bear confinement if captured adult. The young seldom reach maturity when deprived of liberty. They are born generally in the early part of the cold weather, a single one at a birth, two being as rare as twins in the human race. The young one sticks to its mother's body for about seven months, and then begins gradually to shift for itself. So entirely does this animal confine itself to its hands for locomotion about the trees, that it holds anything it may have to carry by its hind hands or feet. In this way I have seen them scamper off with their plunder out of a Karen plantain-garden in the forest.

I have had many of these animals while young in confinement. They were generally feeble, dull, and querulous, sitting huddled upon the ground, and seldom or never climbing trees. On the smooth surface of a matted floor they would run along on their feet and slide on their hands at the same time. By being fed solely on plantains or on milk and rice, they were apt to lose all their fur, presenting in their nude state a most ridiculous appearance. Few recovered from this state; but a change of diet, especially allowing them to help themselves to insects, enabled some to come round, resuming their natural covering. For the most part they were devoid of those pranks and tricks which are exhibited by the young of the *Macacus* and *Inuus*, though occasionally, and if not tied up, they would gambol about with cats, pups, or young monkeys.

The tawny and the black varieties of the Gibbon appear to mix indiscriminately together. The Karens in the Tenasserim provinces consider there is a third variety, which they name "Khayóo pabá," and the Talaïns "Woot-o-padyn" (blue ape). This is probably the party-coloured or mottled phase of the animal, which occurs very often to the southward, in Malacca. The pale variety is more numerous in the district of Amherst than the black one.

Hylobates Lar extends southward to the Straits, and northward to the northerly confines of Pegoo (British Burma): whether it is found throughout Burma proper or not, I cannot ascertain. To the west of the spur dividing British Burma from Arakan, and throughout the latter province into the mountains

east of Chittagong, is found only *Hylobates Hoolock*. And further northward, in the forests and hills of Cachar, Munnipoor, and Assam, exists either a third species (not yet, I believe, distinguished by naturalists) or, if the same species as *H. Hoolock*, so strongly modified as to be larger and stouter, with a totally different call, and subject to vary in colour the same as *H. Lar*, which *H. Hoolock* in Arakan is not.

I subjoin the dimensions of an adult male specimen of *Hylobates Lar* shot near Hlyng bway, Tenasserim province, January 1855. But I believe it attains a larger size.

Length from crown to posteriors $1' \; 7\frac{5}{8}''$.
Humerus $9\frac{1}{2}''$, radius $9\frac{1}{2}''$, hand $6''$; total $2' \; 1''$.
Femur $7\frac{1}{2}''$, tibia $7\frac{1}{2}''$, foot $4\frac{1}{2}''$; total $1' \; 7\frac{1}{2}''$.
Height when standing upright about $2' \; 6''$.

I should not omit mentioning the peculiar manner in which this species drinks, which is by scooping up the water in its long narrow hand, and thus conveying a miserably small quantity at a time to its mouth. It is to be hoped the animal is not much troubled with thirst.

XLI.—*On the* Menispermaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 261.]

18. Hypserpa.

This genus consists of a distinct group of plants, natives of Asia and the islands of the Oriental archipelago, the type of which is the *Cocculus cuspidatus* of Wallich. It is distinguished from *Cocculus* by its cyclical slender embryo imbedded in simple albumen, in which respect it approaches *Pericampylus*; but it differs from that genus and all others of the *Leptogoneæ*, except *Limacia*, in its cotyledons being accumbent (not incumbent). It is also notable for its unsymmetrical flowers; for few of its species agree in the number of sepals, petals, stamens, or ovaries—a very unusual occurrence in the order. The authors of the 'Flora Indica' and of the new 'Genera Plantarum' have refused to admit the validity of the genus, as they do not consider the imbrication of its inner sepals to be a character of any importance; and therefore they unite it with the genus *Limacia* of Loureiro. In this hasty determination they have entirely overlooked other circumstances which establish marked distinctions between the two genera. In all the species of *Limacia* the sepals are constantly thick and valvate in æstivation, while in every case in *Hypserpa* the sepals have broad, thin, membrana-

ceous margins, which sometimes for half their breadth overlap each other in æstivation. In other families where the difference is so extremely salient as it is in these instances, it is allowed to be a good generic distinction; and there is no reason for denying its validity in *Hypserpa*, especially as it is accompanied by other prominent points of divergence. In *Limacia* the stamens are equal in number to the petals, whose lateral lobes entirely embrace the filaments, which are affixed to their claws; they are always in ternary series, and symmetrical, the numbers being constantly six in one group, and as regularly three in the other section; the number of ovaries is constantly three. In *Hypserpa* there is no symmetry whatever in any of its parts; the sepals vary in number in the different species; and the petals are equally variable, being four, five, or six, and they do not embrace the filaments, though their sides curve inwards; the number of stamens is always in excess of the petals, being generally six, seven, or eight, and in one instance I found nine; in some species the ovaries are 3, rarely six, and in two species constantly two. In *Hypserpa* the embryo is very slender and terete; in *Limacia* it is somewhat broader, flatter, and foriform. In *Hypserpa* the radicle is equal in length to, or somewhat longer than, the cotyledons; in *Limacia* the radicle is only a quarter of their length. These valid differences, which I have constantly found in all the cases that have fallen under my observation, unquestionably establish the claims of *Hypserpa*. The same authorities, after their usual method, annihilate all the species of *Hypserpa*, except the type, ignoring all the remainder; while I have here enumerated nine species.

Hypserpa, nob.—*Flores* dioici. *Masc. Sepala* numero vario, 8, 9, usque ad 12, 2–3-serialia, quorum exteriora bracteiformia, 5–6 interiora majora, oblonga, marginibus late membranaceis erosis et ciliatis, æstivatione imbricata. *Petala* 6, 5, vel 4, sepalis paulo minora, obovata, carnosula. *Stamina* 6 ad 10, biseriata, quorum 4–5–6 exteriora, reliqua centralia; *filamenta* carnosula, subcompressa, incurvata, apice incrassata; *antheræ* 2-lobæ, lobis ovatis, distinctis, subobliquis, apice filamenti utroque latere subimmersis, rima longitudinali dehiscentibus. *Fœm. Sepala* 8, oblonga, crassiuscula, margine membranacea, imbricatim disposita, quorum 2 exteriora bracteiformia. *Petala* 5–6, oblonga, concava, carnosula. *Stamina* sterilia 6, cum petalis gynæcio inserta, apice clavata, antheris subobsoletis. *Ovaria* 6, rarius 3, interdum 2, gynæcio centrali insita; *stylus* brevissimus; *stigma* oblongo-lineare, profunde canaliculatum, subtrilobum, vel incisum. *Drupæ* abortione 2–3, transversim ovatæ, carnosæ, styli vestigio basi propinquo no-

tatæ: *putamen* valde osseum, subglobosum, paulo compressum, peripheriam versus utrinque radiatim sulcatum, carina peripherica lævi, 1-loculare, loculo lunato circa condylum gyrato; *condylum* excentricum, intus septulo integro 2-cameratum, utrinque meatu lineari parvo extus perforatum; *semen* loculo conforme, dorso angulatum, ventre subplanum; *integumenta* tenuia, medio *raphes* ventralis prominentis linearis condylo affixa; *embryo* intra *albumen* simplex copiosum carnosum fere annulosum tenuiter elongatus, omnino teres, *cotyledonibus* accumbentibus, ad hilum tensis, *radiculæ* superæ ad stylum spectanti æqualibus, vel subbrevioribus.

Frutices *scandentes Asiæ tropicæ et insularum indigenæ*; folia *elliptica, sæpius glaberrima, 3-nervia, breviter petiolata*; racemi *axillares, petiolum æquantes, vel duplo longiores.*

The following species are enumerated in my 'Contributions to Botany,' vol. iii.:—

1. *Hypserpa cuspidata,* nob.;—Cocculus cuspidatus, *Wall.*;—Limacia cuspidata, *Hook. & Th.*—Penins. Ind. et Ceylon (Wall. Cat. 4960; Gardner, 30; Thwaites, 1051).
2. —— *nitida,* nob.;—Limacia cuspidata, *Hook. & Th. in part.*—Hong Kong.
3. —— *prævaricata,* nob.—Pulo Penang; ins. Philip. (Cuming, 1252).
4. —— *funifera,* nob.—Africa centralis (Mellor).
5. —— *heteromera,* nob.—Borneo (Motley, 710).
6. —— *propensa,* nob.—Borneo (Motley, 179).
7. —— *pauciflora,* nob.—Ceylon (Walker).
8. —— *triflora,* nob.;—Cocculus triflorus, *DC.*;—Limacia microphylla, *Miq.*—Sumatra et Java.
9. —— *uniflora,* nob.—Ceylon (Walker).

19. Limacia.

In describing *Hypserpa,* I have shown it to be very distinct from *Limacia,* with which it has been confounded by the authors of the 'Flora Indica' and the 'Genera Plantarum.' In habit there is a certain degree of resemblance between them; but in their floral structure there is a positive want of compatibility. In *Limacia* the male flowers are constantly isomerous, the inner row of sepals is three; they are thick, fleshy, pilose on both sides, with a decidedly valvate æstivation; the petals are invariably six, and embrace as many stamens standing opposite to them; there is, however, a distinct group in which only three stamens are present, but the flowers are still isomerous: rudiments of three or six ovaries are found in the centre of the

flower, which are not seen in *Hypserpa*. In this latter genus the flowers are always heteromerous, the more membranaceous sepals are conspicuously imbricated in æstivation, and there are many other discrepant characters which it is not necessary to repeat here, as they have been already described. *Limacia* will therefore maintain its ground, distinct from *Hypserpa*, within the limits I pointed out thirteen years ago; but, as at that period I had not seen the fruit, *Limacia* was then placed among the *Pachygoneæ*, in accordance with the meagre details of its structure given by Loureiro. When I first noticed this group of plants, I named it *Stereoclea*, on account of the peculiar æstivation of its sepals; but on seeing Loureiro's plant in the British Museum, I instantly recognized it as the same: the previous name was therefore made to indicate the triandrous section, which for the present is retained in the genus, but which probably will turn out to be distinct when its fruit is known. There is a general analogy between *Limacia* and *Hypserpa* in the form of the putamen, the kind of condyle, and the structure of the albuminous seed: the former has the same accumbent cotyledons as the latter; but the entire embryo is broader and more flattened, and there is a difference in the relative lengths of the radicle and cotyledons. The authors of the 'Flora Indica' and of the 'Genera Plantarum' place *Limacia* in the same tribe with *Cocculus*; but it cannot consistently remain there, owing to the peculiar structure of the embryo. The species of *Limacia* are distributed through tropical Asia, the Eastern archipelago, China, and Japan; but the botanists above mentioned record only three of them.

LIMACIA, Lour.—*Flores* dioici. *Masc. Sepala* 9, in ordine ternario alternatim disposita, 6 exteriora minora, bracteiformia, 3 interiora majora, concava, subrotunda, utrinque sericea, æstivatione arcte valvata, dein apicibus reflexis, marginibus basalibus conniventibus. *Petala* 6, subbiserialia, obovata, unguiculata, sepalis multo minora, lateribus inflexis stamina amplectentibus. *Stamina* 6 (interdum 3), libera, petalis subæqualia, ad eorum unguem adnata, et andrœcio centrali imo coalita; *filamenta* subincurva, erecta, carnosula, apice incrassata, interdum antice hirsuta; *antheræ* conniventes, 2-lobæ, cordatæ, marginibus rima longitudinali utrinque hiantes. *Ovaria rudimentaria* apice andrœcii, punctiformia.—*Fœm. Sepala* et *petala* ut in masc. *Stamina* sterilia 6 (vel 3), æqualia; *filamenta* tenuiora, erecta, petalis involuta, apice (ex antheris effœtis) 2-loba. *Ovaria* 3, libera, sepalis interioribus opposita, gibba, dense hirsuta, gynæcio brevi hirsuto insita, 1-locularia, 1-ovulata; *stylus* brevis; *stigma* excentricum, subtrilobum,

concavum, reflexum, glabrum. *Drupæ* 3, vel abortu pauciores, gibbose subglobosæ, vel transversim oblongæ, carnosæ, glabræ, siccæ, rugulosæ; *putamen* osseum, subglobosum, vel oblongum, subcompressum, zona peripherica canaliculata circumdatum, loculo cyclice hippocrepiformi condylum circumcingente; *condylus* magnus, excentrice centralis, convexus, intus septulo perforato 2-cameratus, meatu lineari vel ovato extus utrinque transversim pertusus. *Semen* loculo conforme, fere annulare, intus subplanum et lateraliter compressum; *integumenta* tenuia, ad faciem ventralem *raphe* longitudinali signata, et hinc intra fissuram condyli insinuata; *embryo* intra *albumen* simplex inclusus, per totam longitudinem tenuissimus, fere annularis, pariter compresso-teres, *cotyledonibus* accumbentibus, *radicula* supera ad stylum spectante 4-plo longioribus.

Frutices *scandentes in Asia tropica et in insulis crescentes;* folia *elliptica, acuminata, pleraque glabra,* 3-*nervia, petiolata*; inflorescentia *supra-axillari, paniculata, petiolo longior et folio brevior*; flores *minimi, velutini.*

The characters of the following species are given in the 'Contributions to Botany,' vol. iii.

§ I. Eulimacia. *Flores hexandri.*

1. *Limacia scandens,* Lour.—Cochin China (Loureiro).
2. —— *oblonga,* nob.;—Cocculus oblongus, *Wall.*—Malacca.
3. —— *velutina,* nob.;—Cocculus velutinus, *Wall.*—Sincapore (Wall. Cat. 4970); Moulmein (Lobb, 335); ins. Philip. (Cuming, 2402).
4. —— *distincta,* nob.—Mergui (Griffiths).
5. —— *inornata,* nob.—Sincapore (Lobb).
6. —— *longifolia,* nob.;—Cocculus longifolius, *DC.*—Timor.

§ II. Stereoclea. *Flores triandri.*

7. —— *triandra,* nob.; Menispermum triandrum, *Roxb.*;—Cocculus triandrus, *Coleb.* (Wall. 4962).
8. —— *Wallichiana,* nob.—Amherst (Wall. Cat. 459 c) (non a, b).
9. —— *Amherstiana,* nob.;—Cocculus Amherstianus, *DC.*

20. Menispermum.

This genus, formerly numerous in species, is now confined to two extratropical climbing plants, one of North-American, the other of North-Asian growth, both in latitudes beyond the parallel of 30°. The authors of the 'Flora Indica' state that the genus only differs from *Cocculus* in having twelve to eighteen

stamens, instead of six, which opinion is sanctioned by the authors of the new 'Genera Plantarum' in saying "vix satis a *Cocculo* differt." Such an opinion must have been formed without their having examined the plants with sufficient attention. The general habit of *Menispermum*, its many-lobed, cordate, peltate (not palate) leaves, the form of its petals, and the variable number of its floral parts are quite at variance with *Cocculus*; and at the same time there is so wide a difference in the organization of its putamen and seed that the two genera cannot even remain in the same tribe. In *Menispermum* the very compressed putamen has a condyle in the form of two very thin, reniform, and closely parallel plates, round the edge of which the narrow and nearly annular cell is circumfluent, and this is externally marked by one dorsal and two lateral prominent terete rings, finely crenated across, and leaving corresponding impressions inside the cell: the albumen, which fills the cell, is therefore in the form of a narrow tricarinated ring; and it contains an almost filiform embryo, in which the slender cotyledons are about the length of the radicle, and not broader than it. In *Cocculus*, on the other hand, the putamen is much more globular, has no prominent lateral ridges, and only a small smooth dorsal carina; the condyle forms a large thick bony mass, round which the nearly annular broad cell, flattened on the ventral side, is circumscribed; and it is divided by a septum into two lateral chambers, each having an external aperture: the seed has the cyclical shape of the cell, and its embryo, imbedded in albumen, is formed of two transversely broad, foliaceous, incumbent cotyledons, of twice the length and four times the breadth of the terete radicle. Under such opposite conditions of structure, it is difficult to conceive how the idea of a close approximation of the two genera could have been entertained. The validity of *Menispermum* as a very distinct genus is unquestionable: as now restricted, it has been well defined by Prof. Asa Gray; but it is desirable to amplify its diagnosis in the following manner:—

MENISPERMUM, Tournef., Linn.—*Flores* dioici. *Masc. Sepala* 6 (interdum abortu 4), biserialia, exteriora minora, spathulato-oblonga, membranacea, concava, æstivatione imbricata. *Petala* numero varia, 6–9, obovata, unguiculata, concava, apice subcucullata, lateribus supra medium auriculatis et involutis. *Stamina* 12–18, interdum 24, centro pluriserialiter affixa: *filamenta* compresso-teretia; *antheræ* ovatæ, basifixæ, filamento latiores, 2-lobæ, lobis adnatis, margine longitudinaliter dehiscentibus.—*Fœm. Sepala* et *petala* ut in masc., sed latiora et breviora. *Stamina* sterilia tot quot petala, et iis opposita, apice 2-glandulosa, imo gynæcii affixa. *Ovaria* 3, gibba,

ovata, apice rostellata, *gynæcio* brevi cylindraceo suffulta; *stylus* subnullus; *stigma* excentricum, radiato-laciniatum. *Drupæ* 3, pisiformes, valde gibbæ, stigmate basin versus approximato notatæ; *putamen* reniformi-orbiculare, valde compressum, carinis 3 teretibus crenatis prominentibus subannularibus (1 dorsali, 2 lateralibus) signatum, 1-loculare, loculo lunato condylum circumcingente; *condylus* reniformi-laminiformis; *semen* 3-carinatum, loculo conforme; *integumenta* tenuissima, ventre laxa, et hinc per raphen in sulcum condyli profunde intrusa; *embryo* filiformi-teres, in *albumine* simplici fere annularis, *cotyledonibus* semiteretibus, incumbentibus, *radicula* supera ad stylum spectante paululo longioribus.

Frutices *scandentes in America septentrionali et in Asia boreali vigentes;* folia *alterna, petiolata, sæpius peltata, orbicularia vel angulato-lobata, glabriuscula vel pubescentia;* paniculæ *supra-axillares, solitariæ vel geminæ, ad medium vel ultra medium nudæ, trichotome vel alternatim ramosæ aut umbellatæ.*

The following species are enumerated in my 'Contributions to Botany,' vol. iii.:—

1. *Menispermum Canadense,* Linn. Sp. 1468; DC. Syst. i. 540; Prodr. i. 102; Lam. Dict., &c.; Menispermum Smilacinum, *DC. l. c.* 541; Cissampelos Smilacina, *Linn.* 1473; *Jacq. Coll.* iv. 128; *Icon. rar.* iii. tab. 629.—Amer. sept.
2. —— *Dahuricum,* DC. Syst. i. 540; Prodr. i. 102; Deless. Icon. i. 26, tab. 100; M. Canadensis, var. *β, Lam. Dict.* iv. 95.—Asia septentr.; Irkutsk (Turczaninow); Dahuria (Fisher); China (in herb. Lindl.); in hort. bot. Kew. cult. (sub nom. *M. Canadense*).

21. Pericampylus.

This genus was proposed by me in 1851 for a small group of East-Indian plants, the type of which is the *Cocculus incanus,* Coleb. It has been adopted by the authors of the 'Flora Indica,' who remark that "it has the fruit of *Cissampelos* or *Stephania,* with the flowers of the tribe *Cocculeæ*; the 2-partite style and the peculiar inflorescence distinguish the genus." The authors of the new 'Genera Plantarum' go so far as to state that it is not sufficiently distinct from *Cocculus.* This opinion has evidently been formed under a complete misconception of its structure, as the facts here adduced will show: they would have been much nearer the truth if they had so contrasted it with *Menispermum. Pericampylus* differs from the latter genus in its nearly palate leaves, in the isometrical number of its floral parts, in its larger spathulate sepals, in the large, fleshy, globose or clavate termination of the filaments, where they are suddenly

bent back extrorsely at a right angle, and upon which the anther-cells are laterally imbedded, with a narrow and sometimes excurrent connective between them: it differs no less in its excentric style, with a bifid or twice-bifid stigma; in its putamen, which (although with a condyle like that of *Menispermum*) has the whole of its external ring covered by two or three lateral and two dorsal concentric rows of tubercular spines, with transverse radiating grooves between the spines. *Pericampylus,* in the structure of its putamen and seed, differs as widely from *Cocculus* as *Menispermum* has been shown to be at variance with that genus—a difference which places *Cocculus* in a separate tribe. The inner surface of the cell of the putamen in *Pericampylus* and the external corresponding face of the seed are marked by broad radiating grooves, conformable with the spaces between the external spines; the embryo, as in *Menispermum,* is very long, uniformly very slender, quite different from the thick foliaceous cotyledons of *Cocculus,* where they are greatly broader than the short terete radicle.

Pericampylus, nob.—*Flores* dioici. *Masc. Sepala* 9, ternatim disposita, quorum 3 exteriora bracteiformia, minutissima, 3 interiora spathulato-oblonga, 3 intermedia paulo longiora, oblonga, extus pilosa, æstivatione imbricata. *Petala* 6, sepalis opposita, et 3-plo breviora, cuneato-ovata, apice subtruncata vel obsolete 3-loba, marginibus introflexis, ad andrœcium brevissimum unguibus affixa. *Stamina* 6, petalis amplexa, subbiserialia, erecta; *filamenta* omnino libera, andrœcio congregatim imposita, apice ample clavata, gibbosa, et subextrorsum reflexa; *antheræ* 2-lobæ, lobis compresso-globosis, connectivo angusto subexcurrente sejunctis, utrinque rima laterali hiantibus.—*Fœm. Sepala* 6, ut in masc. *Petala* 6, latiora, apice truncata lateribusque inflexa. *Stamina sterilia* 6, filiformia, apice vix glandulosa, petalis longiora, imo gynæcii affixa. *Ovaria* 3, valde gibbosa, ovata, gynæcio brevi 6-gono imposita, 1-locularia, 1-ovulata; *stylus* brevis, crassus, rostellatus; *stigma* lineare, subito deflexum, supra canaliculatum, ultra medium divaricato-bifidum vel bis bifidum. *Drupæ* 3, gibboso-ovatæ, transversæ, carnosæ, stylo persistente basi proximo notatæ; *putamen* osseum, suborbiculatum, compressum, peripheriam versus utrinque spinulis plurimis acutis vel truncatis in seriebus 2 vel 3 circa condylum concentrice dispositis echinatum, 1-loculare, loculo hippocrepico; *condylus* utrinque concavus et laminiformis, imperforatus; *semen* loculo conforme, radiatim sulcatum; *integumenta* tenuissima, ventre laxa, et hinc per *raphen* in sulcum condyli intrusa; *embryo* teres, gracilis, in *albumine* simplici cyclice arcuatus, *cotyle-*

donibus semiteretibus, incumbentibus, *radicula* supera ad stylum spectante paulo brevioribus.

Frutices *scandentes Asiæ intertropicæ*; ramuli *teretes, retrorsum tomentosi;* folia *subrotunda, subcordata, pubescentia, 5–7-nervia, longiuscule petiolata, petiolo paulo intra marginem affixo*; inflorescentia *supra-axillaris, pubescens, paniculata, trichotome divisa, ramis divaricatis iterumque compositis*; flores *breviter pedicellati, minimi, villosi.*

The following species are described in the third volume of the 'Contributions to Botany:'—

1. *Pericampylus incanus,* nob.; Cocculus incanus, *Coleb.*—Asia intertropica.
2. —— *Assamicus,* nob.—Assam (Jenkins).
3. —— *aduncus,* nob.—Bootan (Griffiths).
4. —— *membranaceus,* nob.; Cocculus membranaceus, *Wall.*—Ind. orient.

22. Pselium.

In 1851 I formed the character of this genus from the examination of Loureiro's typical specimen in the British Museum, which has only male flowers. That botanist, however, was wrong in his generic details, as it is evident that the plant from which he derived the character of the female flower and seed must have been a *Stephania*: in his description of the male flower, he is incorrect in stating that its six petals are twice the length of the six sepals. The authors of the 'Flora Indica' declare that Loureiro's specimen above mentioned is clearly identical with *Pericampylus incanus*: I admit that, as far as regards the leaves, there is much resemblance, but not so in the character of the inflorescence, its very short panicle being very different from the widely spread umbellate inflorescence of *Pericampylus incanus*; its sepals are pilose on both sides, its petals being only one-fifth of their length; the stamens are confluent for more than half their length in a monadelphous column, the union of the three more central being continued to nearly their summit; the filaments are not clavate at the apex, and the anthers are differently constructed. If the union of the stamens had been continued up to the anthers, Loureiro's specimen would not have differed from a *Stephania*; and had they been disunited to the base, it would have been a *Pericampylus*. Under these circumstances, although I confess the difference is small, I should not be justified in abolishing Loureiro's genus. In many other genera of the family a similar feature gives one of their chief distinctive characters; in the union of three of its six filaments into a central column we have a parallel in *Coscinium*; in *Triclisia*, its six stamens are combined together for half or a third of their length;

in *Homocnemia* its four stamens are monadelphous to near their apex; while in *Detandra* and *Syrrhonema* (each with only three stamens) these are united together for more than half their length.

Pselium, Lour.—*Flores* dioici. *Masc. Sepala* 6, spathulato-oblonga, basi longe unguiculata, 2-serialia, 3 exteriora paulo minora, utrinque pilosa. *Petala* 6, glabra, sepalis quinto breviora, spathulato-oblonga, lateribus inflexis, subauriculatis, summo incurvata. *Stamina* 6, æqualia; *filamenta* teretia, ultra medium in columnam centralem monadelpham coalita, 3 interiora fere ad apicem conjuncta; *antheræ* subglobosæ, subquadrilobæ, subextrorsum apicifixæ, utrinque rima transversali dehiscentes.—*Fl. fœm.* ignoti.

Frutex *scandens, Cochinchinensis, pubescens;* folia *reniformia,* 5-*nervia;* petiolus *tenuis;* paniculæ *binæ, supra-axillares, petiolo multo breviora.*

The single species, *Pselium ambiguum,* is described in the 3rd vol. of 'Contributions to Botany.'

23. Ileocarpus.

This genus was proposed by me in 1851 for a plant in Schimper's Abyssinian collection: it is allied to *Pericampylus* and *Menispermum* on account of its putamen and seed, and approaches the following genus, *Homocnemia.* It differs, however, from *Menispermum* in its isomerous stamens, and from *Pericampylus* in its peltate leaves, in having only three membranaceous sepals, three smaller alternate petals, and a single ovary, with a short thick style and a somewhat erect stigma. *Homocnemia* differs from it in its tetramerous arrangement, having four sepals, four minute petals, and one compressed ovary on a disk-shaped support, and an obsoletely 2-lobed stigma. The authors of the 'Flora Indica' and of the new 'Genera Plantarum' unite this genus with *Stephania,* and strangely assert that the typical plant is not distinguishable from *Stephania hernandifolia.* But *Ileocarpus* cannot be reconciled in any way with *Stephania,* on account of the absence of the perforation in the condyle, the presence of which is a universal feature in every species of that genus that I have seen. It cannot be denied that the plant in question has peltate leaves, and a habit like that of *Stephania;* but not more so than are found in *Cyclea, Clypea,* and many species of *Cissampelos*; the latter and *Clypea* are indeed the only genera among the whole group that harmonize with *Ileocarpus* in the structure of the putamen; the latter genus differs from all the rest in the shortness of its cotyledons compared with the length of the radicle.

Ileocarpus, nob.—*Flores* dioici. *Masc.* ignoti.—*Fœm. Sepala* 3, obovata, membranacea. *Petala* 3, alterna, rotundata, imo unguiculata, sepalis dimidio breviora. *Stamina* nulla. *Ovarium* unicum, oblongo-ovatum, glabrum, gynæcio brevi insitum, 1-loculare, *ovulo* unico e facie ventrali appenso; *stylus* brevissimus, crassiusculus; *stigma* 3-fidum, lobis brevibus, teretibus, suberectis. *Drupa* transversim ovata, carnosa, styli vestigio hilo proximo notata; *putamen* obovatum, compressum, peripheriam versus utrinque liris 7 brevibus 2-tuberculatis radiatim dispositis muricatum, 1-loculare, loculo hippocrepiformi circa condylum gyrato; *condylus* ovatus, laminiformis, utrinque concavus et imperforatus. *Semen* valde compressum, hippocrepiforme, extus utrinque radiatim sulcatum; *integumenta* membranacea, margine ventrali laxa, hinc crassiora, et cum *funiculo* filiformi rigido intra fissuram condyli intrusa; *embryo* in *albumine* simplici, carnosus, teres, tenuiter elongatus, hippocrepiformis, *cotyledonibus* semiteretibus, incumbentibus, *radicula* æquilata, iis 3-plo longiore, ad stigma spectante.

Frutex *scandens Abyssinica*; folia *integra, peltata, deltoideo-oblonga, glabra,* 10-*nervia, petiolata;* pedunculus *supra-axillaris, tenuiter filiformis, glaber, apice bracteatus et floribus plurimis capitato-paniculatis munitus;* flores *minuti, glaberrimi.*

The single species, *Ileocarpus Schimperi,* is described in the 3rd vol. of 'Contributions to Botany.'

24. Homocnemia.

This genus, originally proposed by me in 1851, was founded upon a plant in Drège's South-African collection, named by Dr. Meyer *Cissampelos umbellata.* The female flower only is known, which differs from *Ileocarpus* and *Stephania* in having four sepals, four petals, and an ovary with an obsoletely bifid stigma. The authors of the 'Flora Indica' and the new 'Genera Plantarum' make this genus and *Ileocarpus* identical with *Stephania;* but they have no ground on which to justify that determination: it differs from *Stephania* in the number of its floral parts, and in the shape of its ovary and stigma; it is, indeed, nearer to *Clypea,* but sufficiently distinct from either, as the following diagnosis will show:—

Homocnemia, nob.—*Flores* dioici. *Masc.* ignoti.—*Fœm. Sepala* 4, ovata, extus pilosa, per paria opposita, æstivatione imbricata. *Petala* 4, sepalis 3-plo breviora, rotundata, carnosa. *Stamina* nulla. *Ovarium* solitarium, ovatum, breviter stipitatum, compressum, rectum, glabrum, sulco longitudinali latere notatum, 1-loculare, *ovulo* e parieti ventrali appenso;

stylus brevissimus, apice obtuse emarginatus, intus stigmatosus. Cætera ignota.

Suffrutex *Capensis volubilis;* folia *alterna, peltata, longe petiolata;* paniculæ *geminæ vel solitariæ, axillares, petiolo breviores, pedunculo composite umbellato,* umbellis *involucratis,* umbellulis *bracteatis, apice flores* 4 *sessiles gerentibus;* flores *minimi,* 1-*bracteolati.*

Its only known species, *Homocnemia Meyeriana,* is described in the 3rd vol. of the 'Contributions to Botany.'

[To be continued.]

XLII.—*Descriptions of three new Species of Fishes in the Collection of the British Museum.* By Dr. Albert Günther.

Diagramma citrinellum.

D. $\frac{13}{15}$. A. $\frac{3}{7}$. L. lat. 84. L. transv. 13/23.

This species is evidently closely allied to *D. mediterraneum* of Guichenot; but it has fewer anal rays, differently coloured fins, and a less elevated body. The height of the body equals the length of the head, and is less than one-third of the total length (without caudal); the head is considerably longer than high, and its upper profile does not descend very abruptly. The diameter of the eye equals the length of the snout and the width of the interorbital space, and is two-sevenths of the length of the head; the maxillary extends to below the anterior margin of the orbit. Small scales advance to between the nostrils, and cover the præorbital almost entirely. Dorsal spines of moderate length and strength, the fifth, sixth, and seventh being the longest, and two-fifths of the length of the head. The posterior spinous passes gradually into the soft portion of the dorsal, without being separated from it by a notch. The second anal spine is not longer, but stronger, than the third, and is longer and stronger than any of the dorsal spines. Caudal fin truncated. Pectoral rather longer than ventral, the latter not extending to the vent. Scales ctenoid, those of the lateral line irregularly arranged. Head and body blackish ash-coloured; all the fins and the free portion of the tail bright lemon-coloured, with a greenish tinge.

A single very fine example, 11 inches long, was obtained by the Rev. R. T. Lowe, during his last sojourn in the Cape de Verde Islands.

Therapon percoides.

D. $\frac{13}{9}$. A. $\frac{3}{8}$. L. lat. 39. L. transv. 7/13.

The height of the body is contained twice and a half in the total length (without caudal); the length of the head twice and

one-third. Upper surface of the head rather flat and entirely scaleless; snout of moderate length, as long as the diameter of the eye, which is two-sevenths of the length of the head, and somewhat more than the width of the interorbital space. Cleft of the mouth rather narrow; the maxillary scarcely reaching to below the anterior margin of the orbit. Præorbital much narrower posteriorly than anteriorly, with the lower edge indistinctly serrated. Scales on the cheek small, in four or five series. Præoperculum with the angle obtusely rounded, the serratures being equal along the entire edge; operculum with two points, the upper being short and obtuse, the lower spinous and rather prominent; sub- and inter-operculum entire; humeral process finely serrated.

The dorsal fin commences above the axil of the pectoral, and is composed of thirteen spines, the fourth, fifth, and sixth of which are the longest—more than half as long as the head; all the spines are of moderate strength. There is a notch between the spinous and soft portions, the twelfth spine being rather shorter than the thirteenth; the soft dorsal is rather lower than the spinous. The distance between the dorsal and caudal fins is a little less than the height of the tail below the end of the dorsal. The second spine of the anal fin is longer and much stronger than the third, and equal in length to the seventh of the dorsal fin: none of the dorsal spines equals it in strength. Caudal fin scarcely emarginate, one-fifth of the total length. Pectoral rather shorter than ventral, which terminates before reaching the vent. Scales ctenoid; the lateral line follows the curvature of the back.

Teeth in the jaws villiform; none on the palate. Pseudobranchiæ well developed.

Back greenish, shining silvery, passing into pure white below: five black cross bands descend from the back towards the belly; they are only half as wide as the interspaces between them; the first descends from before the dorsal fin towards the axil, the second from the sixth and seventh dorsal spines, the third from the last dorsal spines, and the fourth from the hinder half of the soft dorsal; the fifth crosses the tail. Vertical fins marbled with black. Infraorbital bones with a silvery band.

Two specimens, 5 inches long, were sent by Mr. Krefft, Curator of the Sidney Museum. They were obtained from the Fitzroy River, near Rockhampton, in Queensland.

Catopra malabarica.

D. $\frac{14}{12}$. A. $\frac{3}{8}$. L. lat. 26. L. transv. 3/9.

The height of the body is contained twice and two-fifths in

the total length (without caudal), the length of the head three times; head about as high as long; snout as long as the eye, the diameter of which is two-sevenths of the length of the head, and more than the width of the interorbital space; jaws equal in length anteriorly, the maxillary extending to below the anterior margin of the orbit. Præorbital and angle of the præoperculum without serratures; opercles, throat, and isthmus entirely scaly; cheek with four series of scales. The dorsal fin commences above the end of the gill-cover, and terminates close by the caudal: its spines are of moderate strength and length, and can be received in a groove; those from the fifth to the ninth are the longest, not quite half as long as the head; the last two spines are equal in length; the soft dorsal is elevated and scaly at its base. The second and third anal spines are equal in length and strength, and scarcely longer or stronger than those of the dorsal fin; the soft anal is similar to the corresponding part of the dorsal. Caudal fin rounded, nearly one-fourth of the total length; without scales, except at the base. Pectoral rather narrow, extending as far backwards as the ventral, and shorter than the head; the ventral does not reach to the vent.

Scales with the margin entire; the upper part of the lateral line terminates below the middle of the soft dorsal, above the commencement of the lower part.

The jaws, vomer, and a narrow strip of the palatine bones are armed with bands of villiform teeth. The dentigerous plates on the roof and on the bottom of the mouth appear to have one undivided surface, no separate molar teeth being distinct: the upper is oblong, slightly tapering in front, rounded behind, and somewhat contracted in the middle; the lower is elliptical, and there is a smaller transverse plate behind the larger one.

One specimen, $3\frac{1}{2}$ inches long, has been presented to the British Museum by Dr. F. Day. It was obtained within the hill-ranges of Travancore, on the Malabar coast, where the species does not appear to be very scarce.

BIBLIOGRAPHICAL NOTICE.

Physical Geography for Schools and General Readers.
By M. F. Maury, LL.D. &c. 1864.

This is an interesting book for young people who have to learn the mutual influences of land, water, and air on the surface of the globe. The rivers, lakes, and seas conform to the shape of the ground, and their waters are taken up by the circulating air (or winds) to be again poured down as rain; and these processes, endlessly modified in different regions, and under different climates, both of zones and heights, variously affect the aspect of nature, chiefly through the

vegetable kingdom, thus influencing the distribution of Man upon earth, his commerce, arts, and habits. These are the chief points of Dr. Maury's little work, in which Hydrography and Meteorology have a prominent place, rather than what is usually called "Physical Geography."

The author herein brings the many good facts and theories collected and worked out by long and careful labour in his 'Sailing Directions' and 'Physical Geography of the Sea' to bear on the evidence of creative design in the arrangement of the "physical machinery of our planet," taking for his text, we may say, the words he quotes from Ecclesiastes, i. 7: "All the rivers run into the sea, yet the sea is not full; unto the place from whence the rivers come, thither they return again."

After some definitions of geographical terms, the reader learns something of water in rivers and the sea—what it is, and what it contains—and of ice and clouds. The air comes next, its weight and pressure, its constitution, its movements, and its power of carrying moisture; and the study of heat, in relation with the earth, air, water, and vapour, leads to meteorology and climate and the varied aspects of nature. Mr. Tyndall's eloquent expositions of the nature of heat are warmly welcomed in Captain Maury's pages. Currents of air at sea and on land, dry and moist winds, the distribution of rain, the general fitness of "terrestrial arrangements" and of "terrestrial adaptations," the "beauty and benignity" of natural phenomena, so well known to the "Christian philosopher" who looks to teleological conveniences as the great end and aim of nature,—all these are rather wearisomely illustrated and insisted upon by our hydrographist, whose well-connected facts would not be less clearly stated, nor less easily remembered, if given with less frequent allusions to the 'Sailing Directions,' on the one hand, and to the perfection of the "grand physical machine," on the other.

Given the sun as operator, water and air as machine, and earth as basis, the "physical machine" performs its office; and Books VII., VIII., and IX. treat of the power of heat, of the clouds, the rivers, and the sea (especially comparing the southern with the northern hemisphere), and of "the earth as we behold it." Man in relation to rivers running north and south, through different climatal zones (as the Mississippi, for instance), compared with east and west lines of traffic (as the Amazon or the Mediterranean),—Man in relation to maize as a food adapted for migration, and in relation to regions more or less cultivable, is here considered.

Of volcanic phenomena, of mountain-ranges, of the formation of table-lands, valleys, and other features Dr. Maury says nothing; but his little book is complete in itself, hydrographically considered. We would, however, that he knew something more of natural history—that he would not term the Coral "an insect of the sea"—"the Coralline," nor speak of Rhizopods as "microscopic insects," and, indeed, that he would not class as *insects* all little animals, both of land and water, "that are too small to be recognized as beasts, or birds, or fishes" (p. 122).

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Feb. 9, 1864.—John Gould, Esq., F.R.S., in the Chair.

On a New Species of Megapode. By G. R. Gray.

I have had placed in my hands a specimen of a bird (preserved in spirits) from the Island of Nina Fou*, which, on examination, has proved to be a new species of the remarkable genus *Megapodius*. The specific characters are as follows :—

Megapodius Pritchardii.

Young female. Slaty black†, with the base of most of the feathers white; wings (imperfect, the quills having been mostly cut away) with the first quill fuscous black; the rest are apparently white, probably fuscous black at their tips; upper tail-coverts white; tail fuscous black; abdomen pale fuscous black or slaty; cheeks and upper part of the neck vermilion-red, slightly feathered with small scattered black plumes; bill bright yellow; tarsi and toes pale yellow; claws blackish lead-colour.

Length, from tip of bill to end of tail, 12 or 13 inches.

The specimen from which the description was taken was obtained by Mr. W. T. Pritchard at Nina Fou, which island is situated about halfway between the Feejee Islands and the Samoan Islands, and is far removed to the northward of the Friendly or Tonga Islands, yet it is considered to form part of this latter group. This somewhat isolated island is said to be of small size, of volcanic origin, and peculiarly liable to eruptions and earthquakes. The natives informed him that the bird "laid 200 eggs, and piled them one above another in the shape of a pyramid, the last egg forming the apex." This statement Mr. Pritchard "hesitated to believe; but the natives reiterated it." The bird lives in the bush, runs very fast, and does not fly any distance at a time.

It so happens that the Nina Fou bird was lately recorded in the 'Proceedings of the Zoological Society' (1862, p. 247), from information obtained by Mr. Bennett of Capt. McLeod, who stated that the bird was known to the natives by the name of "Mallow;" and it lives in the scrubs in the centre of the island, about the margin of a large lagoon of brackish water, which has the appearance of having been an extinct crater; the birds lay their eggs on one side only of the lagoon, where the soil is composed of a sulphur-looking sand; the eggs are deposited from 1 to 2 feet beneath the surface.

This latter account is in accordance with the known habits of several of the species of this genus, and Mr. Pritchard was right in doubting the correctness of the marvellous and most improbable story related to him by the natives. It is only by the permission of the king or chief that the eggs or birds can be procured, which is also the case in other localities.

* Onooafow, or Proby Island, or Hope Island, or Good Hope Island.

† Mr. Bennett says, "of an uniform blackish-brown colour." While Mr. Pritchard remarks it to be "of a brownish blue."

The natives of the Tonga Islands informed Mr. Pritchard that the bird was "*not* found on any of their islands, except Nina Fou." There is, however, in the British Museum an egg, with the provisional name of *Megapodius Burnabyi,* which agrees with the description of the Nina Fou egg. It was obtained by Lieut. Burnaby, R.N., at the Hapace Islands, which is the centre cluster of the three groups usually considered to form the Friendly or Tonga Islands. The bird of the Hapace Islands may, when made known, prove to be a species closely allied to the *Megapodius Pritchardii,* if not the same.

On a New Species of Prionops. By G. R. Gray.

I beg to lay before the Meeting the description of a new species of *Prionops,* which has been obtained during the Zambesi expedition.

Prionops tricolor.

Black; back, rump, wing-coverts, and tertials purplish grey; quills fuscous black, from the second to the tenth quills crossed interiorly with a white oblique band; vent, under tail-coverts, and tips of the tail-feathers white; on the latter the white decreases in width from the outer to the central feathers, where it exhibits only a small spot on each feather.

The frontal plumes covering the nostrils are short, turned upwards, and slightly curved backwards in front of the eyes, like those of the *Prionops Talacoma,* which latter species, with the new one, were sent in the first series of birds as from Tette.

The eyes are surrounded by serrated fleshy rings. The bill and feet red; the former is tipped with yellow.

Length 7″ 6‴; wings 5″.

This new species is allied to *Prionops Retzii,* but it is without the white rump, and the tips of the tail-feathers are white on both webs.

Description of a New Species of Gull from Tibet. By J. Gould, Esq., F.R.S., etc.

Chroicocephalus tibetanus, Gould.

Head light chocolate-brown, deepening into black on the nape, sides of the head, and fore part of the neck; back and wings delicate grey; shoulders and edge of the wing pure white; first two primaries black, with an oblong patch of white occupying the basal portion of the outer web and the corresponding portion of the inner web for about half its breadth, and with an oval patch of white near the tip; the remaining quills white, largely tipped and broadly margined along the inner web with black; remainder of the plumage, comprising the neck, under surface, upper and under tail-coverts, pure white; bill, legs, and feet coral-red; nails black.

Total length 16 inches, bill 2 inches, wing $12\frac{1}{2}$ inches, tail 5 inches, tarsi $2\frac{1}{8}$ inches.

Hab. Tibet.

Remark. This fine and very distinct species belongs to that section of the *Laridæ* which comprises the well-known Black-headed Gull,

C. ridibundus, but cannot be confounded with that or any other species, the broad black mark in the centre of its first two primaries, together with its larger size, serving at once to distinguish it. It was brought from Tibet by Major W. E. Hay, F.Z.S.

Notes on some New Lizards from South-Eastern Africa, with the Descriptions of several New Species. By Dr. J. E. Gray, F.R.S., etc.

Dr. John Kirk has most kindly sent to the British Museum a series of Lizards, Snakes, Insects, and other animals collected during the Zambesi expedition, under H. M. Consul the Rev. Dr. Livingstone. As the series of Lizards contains some species which do not appear to have been previously inserted in the 'Systematic Catalogue,' I forward an account of them to the Society.

Gerrhosaurus robustus, Peters, Monatsb. 1854, p. 618.

Hab. Tette (*Peters; Dr. Kirk*).

Dr. Peters gives the word *Caaiia* as the name of this Lizard; but, Dr. Kirk informs me, that word simply means "I do not know," which was probably what the native said when he asked him what they called it.

Common near Tette. The native told Dr Kirk that it entered fowl-houses and killed the fowls, and that it bit very hard.

This species agrees in general appearance with the Lizard figured in Dr. Andrew Smith's 'Illustrations of the Zoology of South Africa,' under the name of *Gerrhosaurus Bibronii*; but the head of the Tette specimen is dark brown like the body, and is spotted with white; while in Dr. Smith's species the head is figured as uniform red-brown.

Teira ornata, n. s.

Blackish brown above (in spirits), with three narrow continuous streaks from the occiput to the base of the tail; head with small symmetrically curved white lines; sides of the head and body with numerous erect, more or less sinuous, white cross bands; chin and beneath white; tail pale reddish brown; ventral shields six-rowed; the throat with a slight fold of a single series of rather larger flat scales; under the ears, scales small, granular, smooth; of the tail elongate, keeled.

Hab. South-Eastern Africa (*Dr. Kirk*).

Lygodactylus, n. g.

Toes free, all clawed, slender, and subcylindrical, with a series of small scales beneath at the base rather dilated ovate, and with two series of regular transverse plates, separated by a central groove beneath, at the end; the thumb (of the hind foot, at least) large. Head, body, and tail covered with uniform granular scales. Tail cylindrical, tapering; front of the vent granular. Labial shields large, similar in form, smaller behind, with a large shield in front of the chin.

This genus agrees with *Thecadactylus* in the form of the plate

beneath the toes; but the toes are freer, and the bases of the toes are slender and subcylindrical. It differs from *Œdura* and *Strophura* in the plates under the toes being of a uniform size, and closely imbricate.

Lygodactylus strigatus, sp. nov.

Grey brown (in spirits) above; crown vermiculated and marbled with black; chin and beneath white, with a black streak commencing from the nostril and continued, enclosing the eye, on the side of the neck and front of the body; tail pale brown; scales on the back very minute, of the crown rather larger; upper labial shields narrow; the lower labial shields 7.7, the four in front of each side larger, becoming gradually smaller; chin-shield six-sided, with two or three smaller shields on each side behind it.

Hab. South-Eastern Africa (*Dr. Kirk*).

Body and head $1\frac{1}{2}$ inch long; tail 1 inch.

Homodactylus, n. g.

The toes free, broad, depressed, rather broader and rounded at the ends; thumb broad like the toes; all granular at the base, and with a single series of broad transverse plates beneath the dilated end, and without any free compressed terminal joints or claws. Back with large tubercles. Tail with rings of large tubercular scales. No preanal or femoral pores.

This genus is like *Phelsuma* in the form of the toes; but the thumb is dilated at the end like the toes; the back is tubercular, and the tail ringed and tubercular.

In the latter character it resembles *Tarentola*, which has the same habit of living in houses; but it has no compressed joints on the middle toes of the hands and feet.

Homodactylus Turneri, sp. nov.

Pale brown; head blackish, tubercular; back with sixteen longitudinal series of large, oblong, more or less keeled, black-brown tubercles, with a central series of much smaller similar tubercles down the vertebral line. The outer side of the limbs with similar tubercles, which are largest on the outer side of the fore legs and hinder side of the thighs and hind legs. Tail with rather distant rings of similar, but rather more acute tubercles, which make six longitudinal series on the base of the tail; underside pale brown, with smooth subequal scales; chin with three band-like shields in front.

Hab. South-Eastern Africa (*Dr. Kirk*). In the houses.

Var. or junior?

Pale brown, with the tubercles paler and with some opaque-white tubercles intermixed. Head with four longitudinal brown streaks up the face to the forehead; a brown streak on the upper margin of the temple, five unequal, rather irregular, dark bands across the back, and some more obscure paler bands across the tail. The toes appear scarcely so much dilated; but in other respects they are like the two larger dark specimens.

I have named this species in honour of J. Aspinall Turner, Esq.,

M.P., who has done so much to make known the zoology of Western Africa, and formed such a fine collection of insects, especially of *Coleoptera*.

M. Auguste Duméril, in the 'Revue et Mag. de Zoologie' for 1851, describes and figures a Nocturnal Lizard, which had been received from Senegal, under the name of *Stenodactylus caudicinctus* (p. 478, t. 13).

M. A. Duméril observes that the slender-toed Geckotians are easily divided into two genera,—the *Gymnodactyles* having slender toes, which are smooth on the edge and with small centrical plates beneath; while the *Stenodactyles* have each side of the toes fringed with small teeth, and the lower surface granular.

I cannot consider this an accurate account of the typical *Stenodactyles*, or, at least, of the toes of the long-known species on which the genus *Stenodactylus* of Cuvier was established; for in that animal, as is well shown in Savigny's figure in the large work on Egypt, the underside of the toes is furnished with a series of plates as in the *Gymnodactyles*, but instead of the plate being entire on the edge, as in *Gymnodactylus*, it is deeply dentated on the outer margin, which caused me, in my 'Catalogue of Lizards in the British Museum,' to form a tribe for it in the family *Geckotidæ*, under the name *Stenodactylina*, which is thus characterized:—

"E. *Toes cylindrical, tapering, toothed on the sides, lower surface with denticulated cross plates*" (*l. c.* p. 177).

The Lizard from Senegal, which M. A. Duméril has referred to this genus, does not agree with this character. It, indeed, has the under surface of its cylindrical tapering toes covered with small acute scales, like the soles of its feet; and therefore I think that it must be formed into a distinct genus, which will form an anomalous group among the Night Lizards, or *Geckotidæ*, characterized by this peculiarity in the toes.

The Senegal Lizard cannot be properly referred to the genus *Stenodactylus* for another reason: the true *Stenodactyli* have the external appearance of the *Agamæ*, so much so that Geoffroy, on Savigny's plate, calls it *L'Agame ponctué*; and M. Audouin, in his 'Explanation of Savigny's Plates,' referred it to the genus *Trapelus*, under the name of *T. Savignii*; while the Senegal Lizard is a typical Gecko in all outward characters except the toes, so much so that when it was first seen it was thought to be an *Eublepharis*, erroneously said to come from Africa.

I propose to call this genus

Psilodactylus, g. n.

Toes short, subcylindrical, tapering, covered with flat scales above, and, like the palms, with small rough granules beneath; thumb like toes, but shorter; all clawed. Tail cylindrical, covered with flat scales, annularly plaited, with a series of larger scales on the edge of the folds; beneath covered with subequal, flat, square scales. Preanal pores in a short angular line. Head depressed, covered with polygonal shields; labial shields low, broad; upper and lower rostral

shields large, similar. Edge of the eyelids reflexed, expanded; pupil large. Back with series of granular tubercles, those on the side formed of three subequal, larger scales. Chin, throat, and belly with smooth polygonal scales.

This genus is very similar to *Eublepharis* (*Hardwickii*) in external appearance and distribution of colour, but differs in the toes being very much shorter, thicker, and cylindrical and tapering, in the ends not being compressed and arched, but thick and cylindrical like the bases, and in the under surface of the toes being covered with small rough granules, like the under surface of the palms or soles of the feet. It differs also in the tubercles of the back being formed of groups of three scales; the central scales or tubercles on the middle of the back are larger than those on each side of it, but on the sides of the back the three scales are of nearly equal size.

In *Eublepharis* the toes are compressed at the end, and have a broad band-like scale beneath, and the tubercles of the back and sides are all formed of a single large scale.

Psilodactylus caudicinctus.

Stenodactylus caudicinctus, A. Duméril, *l. c.*

In spirits, pale whitish; upper part of the head brown, edged with a black horseshoe-shaped band behind; cheek and side of the throat black, varied; back with two very broad irregular-edged black cross bands; tail dark, ringed.

Hab. W. Africa; Old Calabar?

Euprepis gularis, sp. nov.

Pale bronze-green brown (in spirit), with five narrow whitish streaks from the occiput continued on the base of the tail; crown of the head uniform brown; the central dorsal streak with a narrow black edge on each side, the two lateral streaks scarcely dark-edged, the upper one arising from the back edge of the eye, and the lower from the pale scales on the upper lip; the throat, the sides of the face, and neck dark brown, white-speckled. The front edge of the ears with a few very small thin scales.

Hab. South-Eastern Africa.

In the 'Catalogue of Lizards in the British Museum,' I regarded these specimens from South Africa as varieties of the *Euprepis quinquefasciatus* from Western Africa; but on recomparing these specimens with other specimens received since, and with the specimens brought home by Dr. Kirk, I am convinced that they are distinct.

Euprepis Kirkii, sp. nov.

Black-brown; back with three uniform well-marked yellow streaks, the middle one from the end of the nose to the base of the tail, the lateral ones from the eyebrows and continued on the side of the base of the tail, and tail-end blue. There is a streak like the others, but less distinct, on each side of the body, arising from the lips, continued across the ear-hole, and obscurely continued on the side of the base of the tail. The chin and underside of the body and base of the tail whitish; scales with three distinct keels; two series of scales between

each pale streak ; the ear-holes oblong, erect, open, with three very small indistinct prominences on the front edge, which are placed at unequal distances from each other.

Hab. Tette (*Dr. Kirk*).

This species resembles in external appearance the Blue-tailed Skink of North America ; but the central dorsal streak is not forked over the head. It is very like the *E. quinquefasciatus* of Western Africa ; but the dorsal streaks are not black-edged, and the central one is continued to the end of the nose. This is not the case in the latter species, which agrees with *E. Kirkii* in having only two series of scales between each white streak.

Named in honour of Dr. Kirk, its discoverer.

Euprepis Grantii, sp. nov.

Pale bronzed brown, with a broad pale whitish streak on each side of the back, continued from the eyebrows to the lower part of the tail. Sides of the head and neck with a broad blackish streak, enclosing the eye and over the ears. The upper lip and slender streak under the eye opaque white. Scales three-keeled.

Hab. South-Eastern Africa (*Dr. Kirk*).

Chamæleo dilepis, Gray, Cat. Lizards B.M. 266.

The white band on the sides is formed of round groups of white scales of the same size and form as the other scales on the sides. There is also a triangular white spot at the angles of the mouth.

Hab. South-Eastern Africa (*Dr. Kirk*).

Feb. 23, 1864.—John Gould, Esq., F.R.S., in the Chair.

Notice of a New Species of Zorilla. By Dr. J. E. Gray, F.R.S., etc.

The British Museum, rather more than ten years ago, purchased of Mr. Argent the skin of a *Zorilla*, which differs from any others which I have seen. Unfortunately it was without any habitat, and I have been waiting in hopes of a second specimen occurring which would supply this deficiency.

It, however, appears so distinct that I think it now better to give a short account of it, that it may be recorded in the systematic catalogues.

Zorilla albinucha.

Black ; back with four yellowish-white stripes, the two middle streaks short, the outer extending from the occiput to the base of the tail ; tail yellowish white ; forehead, crown, nape, and upper part of the ears pure white.

Hab. ——?

The hair soft and short ; the white hair of the crown and the yellowish hair of the dorsal stripes one-coloured to the base ; the hair of the tail rigid, more or less blackish at the base.

There are two or three small, black, unsymmetrically placed spots on the crown, and the central black streak of the back is extended a

short way up the centre of the nape. The front claws are short and acute.

It differs from the *Zorilla Vaillantii,* Loche (Rev. et Mag. de Zool. 1856, viii. 497, t. 22), in the crown of the head being entirely white, and the streak on the back narrower and well-defined.

On the Osteology of the Kagu (Rhinochetus jubatus). By W. K. Parker.

If we take the terrestrial, amphibious, and aquatic birds as a practical half of the whole class, we shall find that the minor groups into which they break up all fuse into each other at their margins.

If it were not for the fact that the Pigeons, Ardeine birds (e. g. Ibises, Storks, and Herons), and the "Pelecaninæ" have tender young, then a straight line might be drawn through the class, leaving on one side the plunderers, songsters, and other families of the "Aves altrices," and on the other the walking, running, wading, swimming, and diving birds. As it is, however, this interdigitation of the two main halves does not take away the great naturalness of such a subdivision; and the land- and water-birds may be considered as together forming a very natural group.

Certainly these birds have very much in common; and inosculant forms so completely connect together the minor subdivisions as to make one seamless web of these apparently incongruous materials.

This slow but sure melting of family into family, and genus into genus, this mixing of single types so as to form double, triple, and multiple types, makes the ancestral hypothesis very hard to digest, whilst yet it seems to be the only one at hand having any scientific value. It may be an *ignis fatuus,* but, to one perplexed with tracing the mazy labyrinth of types, it looks like a light shining in a dark place.

The *Palamedea* and the Kagu have turned up to me very opportunely just now; they have made me rethink my thoughts, and repeat and vary my observations, on the relationships of the land- and water-groups of birds. The former of these birds—the *Palamedea*—by bringing an essentially Anserine bird so near those outlying "Gallinæ" the Curassow and the Brush-Turkey, shows how it is that there exists so much in common in the skull and face of the Fowl and the Goose; whilst the Kagu, by tying closely together the Trumpeter and the *Eurypyga,* in some degree opens the eyes to understand why the relationship of the Cranes to the Herons, and of both to the Rails, should be so close and intimate.

I have also been brought to re-analyze the families so as to eliminate, if possible, the single or pure from the mixed types, whether merely double or multiple.

Tentatively and cautiously let us separate the true Ralline birds, from the *Notornis* to the Coot; this group may stand as one of the simple-type families.

Parallel with these birds—in some respects more intelligent, in others coming nearer to the reptile—we place the Plovers, not

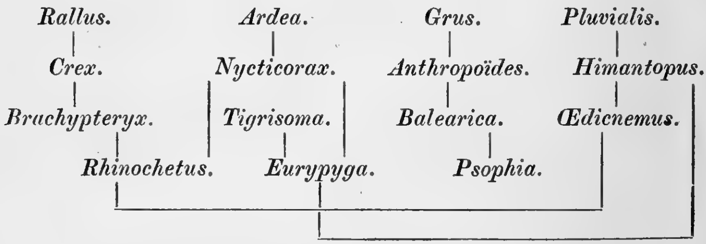
having respect to the length of their bills, but to the degree in which they have retained a certain embryological simplicity of structure, and are thus less typically *ornithic* than their relatives the Gulls, on one hand, and the Ibises, on the other.

The typical Fowls and the typical Geese and Ducks appear to form two more groups of equal value with the Ralline and Pluvialine groups; but as these two simple types do not bear very directly upon the subject of this present paper, they will be considered on some other occasion.

Any one who has mastered the development of a Rail or a Plover will be in a state of fitness to study the meaning of what he will see in the structure of the Heron and of the Crane.

At present my view of the matter is, that, whilst the Heron has risen considerably higher in the bird-scale than the Crane, yet they are intimately related; moreover, that the Heron has full two-thirds of the ralline nature in it to one of the pluvialine, and, on the other hand, that the Crane has in it twice as much of the Plover as of the Rail.

In supposing these birds to be thus double in their nature, I do not forget that they have characters peculiar to themselves alone; *identity-characters* they might be called: we see this everywhere in nature; and those of us who have large families know well that, whilst each child is in one sense a copy of both parents at once, yet he holds his own, and has so much and such well-marked individualism as to make him in a certain sense like the starting-point of divergence towards a distinct species. I here append a sort of scheme, showing some of the more important relationships of the Kagu, one of the best examples of a multiple type:—



The *Rhinochetus*, the *Psophia*, and the *Eurypyga* are on the same level; they are intimately related *inter se*, and very closely also to the Cranes and Herons. I am not aware whether, in placing them on the same line, I have truly indicated the *ornithic* height of each. In the upper line it is certainly not so; yet that is a natural arrangement in one important matter; for the Heron comes near to the Rail, and the Crane to the Plover, and all are intimately related.

The *Psophia* is the truest Crane in the bottom line, yet its skull is principally ralline in character; the *Eurypyga* comes nearest to the Heron: as for the Kagu, whether it be most of a Crane, a Night-

Heron, or a Wingless Rail, I will not say; it has a more distant relationship with the Stone-Plover (*Œdicnemus*).

The *Psophia* has a very phasianine expression of face, and the structure of its head answers to that look very considerably; whilst the *Eurypyga* has stretched just as far out for some of its characters, and is unmistakeably related to the Stilt-Plover (*Himantopus*). It would be tedious if the details were given; but I hold myself ready to prove my assertions. Leaving the beautiful and complex skulls of the Kagu, the *Eurypyga*, and the *Psophia* (merely remarking that the first is most like that of a Night-Heron, the second halfway between that of the Kagu and the *Himantopus*, and that the third is, as it were, the skull of a phasianine Rail), let us turn to the sternum in these birds.

In each case this bone answers best to that of a newly hatched Crane (e. g. *Grus montignesia*), whilst it is, as yet, totally unossified. The breast-bone of the Trumpeter comes nearest that of the Crowned Crane (*Balearica*); the Kagu's sternum is truest to the embryo Crane; whilst that of the *Eurypyga* answers in nature both to that of the young Crane and the young Heron. The sternum of the true Crane, in its early condition, is very interesting, as, besides its own proper characters, it shows a dying-out of the *pluvialine* inner hyposternal processes. The dorsal vertebræ are largely anchylosed together in these three mixed types—the Kagu, *Psophia*, and *Eurypyga*; and this occurs in all the Cranes more or less, and also in that strange Crane-Goose the Flamingo.

The furculum of the Kagu is but little stronger, and only a little more U-shaped, than that of the *Brachypteryx*; that of the *Psophia* has its rami more divergent than that of a Crane, and the process at the angle is weaker; and, lastly, the furculum of the *Eurypyga* is intermediate between those of the *Psophia* and the Stilt-Plover.

That which strikes the eye at once in the pelvis of the Kagu is the great height and steepness of the iliac crests, and the peculiar bend downwards of the hinder part of the sacrum; this is equally well seen in the pelvis of the *Brachypteryx* and the *Psophia*.

This has a further interest; for that which gives character to the pelvis of the *Talegalla*, as compared with that of other gallinaceous birds, is this peculiar height of the iliac crests.

In the *Eurypyga* this character is not only toned down, as it were, but the posterior part of the pelvis is much broader: and this part of the bird alone would only indicate a *specific* difference from that peculiar Ibidine Stork the *Umbretta*; for its pelvis differs but little from that of the *Eurypyga*, save in being stronger, and it answers to that common broad kind so constantly seen in every modification of an essentially pluvialine bird.

My last remark is, that all the outliers of the typical "Ardeinæ" —*Balæniceps, Scopus, Eurypyga, Rhinochetus,* and the Storks— *take hands* round the well-defined central group, viz. the Herons, Bitterns, Egrets, Night-Herons, Tiger-Bitterns, and Boat-bill.

Description of a New Species of Chrysococcyx. By John Gould, F.R.S., etc.

Chrysococcyx Schomburgki, Gould.

Crown of the head, neck, back, and scapularies rich shining coppery bluish green; wing-coverts bright shining green, margined with a coppery hue; first three primaries dark bluish black, with a stripe of white down the central part of their inner webs; the remainder of the primaries bluish green on their outer webs, with a tinge of copper on their margins, the inner webs bluish black with a broad stripe of white along their basal margin; tail-feathers deep bluish green, with a tinge of copper on their margins, and the outer feathers on each side crossed by three irregular bands of white, and with an oval spot of white at the tip; throat, under surface of the body, and under wing-coverts alternately banded with pure white and bronzy green; under tail-coverts beautiful grass-green, those nearest the body largely tipped with white; bill orange, tipped with black; tarsi and feet olive.

Total length $6\frac{1}{2}$ inches, bill $\frac{7}{8}$, wing $4\frac{1}{2}$, tail $3\frac{1}{4}$, tarsi $\frac{1}{2}$.

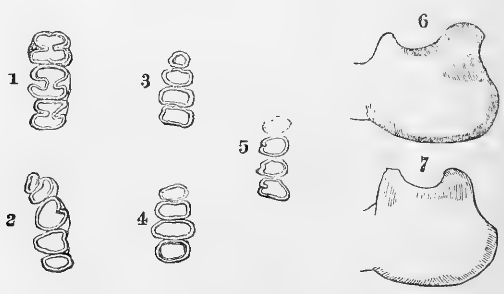
Hab. Siam.

Remark. This very beautiful species is nearly allied to the *Chrysococcyx Hodgsoni* of Moore (*C. smaragdineus*, Blyth) and *C. xanthorhynchus* of Horsfield. It was sent to me from Siam by Sir Robert Schomburgk, Her Britannic Majesty's Consul-General for that country; and I have named it in honour of one whose devotion to natural science is well known, and to whose merits in this respect I have had the pleasure of bearing testimony upon several previous occasions.

March 8, 1864.—Dr. J. E. Gray, F.R.S., in the Chair.

Notes on the Species of Sand-Moles (Georychus). By Dr. J. E. Gray, F.R.S., etc.

Dr. Sclater having requested me to determine two Sand-Moles (*Georychus*) brought home by Capt. Speke, I have been induced to re-examine all the specimens of the genus in the British Museum.



The species may be divided into two groups according to their fur. Thus the fur of *G. capensis*, *G. albifrons*, and *G. unicolor* is very similar, being soft, long, and fluffy; while the fur of *G. cæcutiens*,

G. damarensis, and *G. holosericeus* is also much alike, but differs from the fur of the other species in being shorter, rather more rigid, apparently closer.

The genus may be divided into four groups by the form of the grinders, thus :—

A. *Grinders* $\frac{3-3}{3-3}$. *The crown of the upper and lower grinders nearly square, with a fold or groove on the inner and outer edges.* GEORYCHUS. (Fig. 1.)

1. GEORYCHUS CAPENSIS, Gray, Cat. B.M. p. 148; see Waterhouse, Ann. N. H. viii. t. 2. f. 2.

The perforation on the side of the skull in front of the orbit oblong, subtrigonal, almost as wide as high; forehead with a slight wing-like expansion over the front of the orbit; the hinder wing of the lower jaw longer than high, with a slightly rounded outline beneath. (Fig. 6.)

Hab. Cape of Good Hope.

2. GEORYCHUS ALBIFRONS, n. s.

Fur ashy grey, with a large white spot on the forehead.

Hab. E. Africa (*Capt. Speke*).

This species is very like *G. capensis,* both in the colouring of the fur and in the form of the grinders, but is not more than one-third the size, and it has a large white spot on the forehead, and no white on the cheeks. There is the same difference in the size of the skull; and the teeth are more worn, showing that it is as old. The brain-box of the skull is much more ventricose. The teeth have a distinct fold on the inner side, but scarcely so on the outer; but then they are much worn. The expansion on the hinder part of the lower jaw is nearly of the same form as that of *G. capensis.*

Dr. Peters, in his 'Nat. Reise nach Mossambique,' t. 35. f. 3, gives a figure of the top of what he believes to be a young specimen of *Bathyergus cæcutiens.* It is something like the skull of this species; but it may be the skull of the species to which Dr. Peters refers it, for unfortunately the teeth, which would determine the question, are not figured.

B. *Grinders* $\frac{4-4}{4-4}$. *Crown of the front upper small, oblong, transverse, simple; of second, third, and fourth subtrigonal, with a distinct fold or groove on the broader inner side; the second tooth the smallest: the first lower oblong, small; the second square; the third trigonal, the hinder side the smallest, with a subtrifoliate crown. The hinder wing of the lower jaw broad, nearly as high as wide, with a strongly arched outline below.* HELIOPHOBIUS, Peters. (Figs. 2 & 7.)

3. GEORYCHUS PALLIDUS. (Teeth, fig. 2; jaw, fig. 7.)

Rufous grey; side of face, chin, and beneath paler yellow-grey.

Hab. E. Africa (*Capt. Speke*).

I have very little doubt that this is the animal figured by Dr. Peters (Reise nach Mossambique, t. 31) under the name of *Bathyergus argenteo-cinereus*, and of which the skull is that figured as *Heliophobius argenteo-cinereus* (t. 35. f. 2), and described under the latter name in the 'Bericht,' 1846, p. 159; but he specially describes it as having six grinders in each jaw, where we have only four. I think that must have been an anomaly in his specimen; indeed the figure does not show six well-formed teeth.

Dr. Peters describes, and his figure represents, the fur as of a uniform colour. Our specimen is paler on the cheeks and underpart of the body.

C. *Grinders* $\frac{4-4}{4-4}$, *all nearly similar and of nearly equal size, the hinder being only slightly the smallest. The crown of the upper ones is oblong, rounded, and with a central fold on the outer side. The crown of the lower with a fold in the middle of each side, the outer fold of the last one being almost, if not quite, obsolete on the outer side. The wing of the hinder part of the lower jaw longer than high, with a nearly straight lower edge.* CRYPTOMYS. (Figs. 3 & 6.)

4. GEORYCHUS HOLOSERICEUS, Wagner.

Hab. S. Africa.

D. *Grinders* $\frac{4-4}{4-4}$. *The upper grinders oblong, transverse, wider than long, the front the largest; the hinder very small, nearly circular. The lower grinders oblong, much wider than long; the three front subequal; the hinder smaller, nearly circular. The posterior wing of the lower jaw longer than high, with a nearly straight lower margin.* CŒTOMYS. (Figs. 4 & 6.)

5. GEORYCHUS CÆCUTIENS, Gray, Cat. Mam. B.M. 149. (Teeth, fig. 4.)

Bathyergus cæcutiens, Licht.
? *B. Hotentottus*, Lesson.
? *B. Ludwigii*, A. Smith.

Fur short, close, uniform grey-brown; the perforation in the side of the nose, in front of the orbit, large, oblong, erect.

Hab. Natal.

6. GEORYCHUS DAMARENSIS, Gray, Cat. Mamm. B. M. 149. (Teeth, fig. 5.)

Bathyergus damarensis, Ogilby, P. Z. S.

Fur short, uniform grey-brown, with a large white spot on the back of the head.

Hab. Damara-land.

This animal greatly resembles the preceding, but is larger, and has the white spot on the back of the head. The imperfect skull (with

part of the teeth) in the Museum resembles the skull of the preceding in most particulars, but is rather larger in size, and the perforation in the side of the nose, at the front edge of the orbit, is smaller and not so oblong, being only a little higher than wide.

Additional Observations on Dermatemys, a Genus of Emydidæ from Central America. By Dr. J. E. Gray, F.R.S., etc.

In the 'Proceedings of the Zoological Society' for 1847, p. 53, I described a new genus of *Emydidæ*, under the name of *Dermatemys Mawii*; and in the 'Catalogue of Shield Reptiles in the British Museum' I figured the shell of the animal in detail.

This genus was only established on a single shell, without any part of the animal attached to it, which was then in the Museum of this Society, having been presented by Lieut. Mawe, R.N. This specimen has since been transferred to the collection of the British Museum.

Some doubts have been expressed as to the position of the genus in the family *Emydidæ*; and one naturalist has even gone so far as to doubt the propriety of establishing a genus from the examination of the single specimen, which he was inclined to believe was only an abnormal form of a typical *Emys*. This I could not admit; for, even if it were an accidental monstrosity, we did not know an *Emys* to which it could be referred.

M. Bibron, when in England, named the specimen, in the MS. Catalogue of the Zoological Society, *Emys Mawii*, a name which I adopted when I originally described it.

More lately the Museum at Paris appears to have received a specimen with the animal, for I find it shortly noticed in M. A. Duméril's 'Catalogue of the Paris Museum' under the name of *Emys Berrardi*, with the following account of the animal:—"Head uniform brown, flat, broad, rather large; jaws toothed; toes broadly webbed; tail strong, rather long." It was sent from M. Berrard from Vera Cruz. *Emys Berrardi* is also described and figured by A. Duméril in the sixth volume of the 'Archives du Muséum,' p. 231, t. 15.

It is to be observed that in the short notice of the species in the 'Catalogue of the Paris Museum' the series of large shields on the external symphysis, which is a peculiarity of *Dermatemys Mawii*, is not mentioned; and they are to be looked for in vain in the longer description in the 'Archives du Muséum,' or in the plate which accompanies that paper. Yet there can be no doubt that both the descriptions and figure are intended for the animal under discussion, as M. Duméril admits that they received one specimen from Lieut. Mawe (or "Maw," as it is printed), which no doubt they obtained from the Zoological Society when M. Bibron was in London. However, the figure is more beautiful as a work of art than accurate as a natural-history drawing; but then herpetologists must by this time

have become accustomed to M. Auguste Duméril's want of attention to such details.

Professor Agassiz, probably deceived by these inaccuracies, observed:—"*E. Berrardi* seems to belong to the genus *Ptychemys*, judging from the description and figure of the jaws." (Contrib. p. 432.)

In Mr. Salvin's collection there is a specimen of this Tortoise, with the animal; but, unfortunately, the specimen is not well preserved: it seems to have been allowed to get dry from evaporation of the spirit, and then to have been placed in spirit again. However, it is in a sufficiently good condition to allow of a description of the more prominent characters of the animal; and it shows that the peculiar disposition of the sternal plate, on which the genus was described (though overlooked by M. Duméril), belongs to the normal characters of the animal. The head is rather large, flat above, and covered with a soft, thin, continuous skin; the nose shelving upward, conical; nostril terminal; mouth inferior, considerably behind the end of the nose; beak horny, rather sinuated at the sides; chin not bearded; the limbs strong, well developed; the legs covered with small scales; the front of the fore legs with numerous, unequal, very slender, band-like cross shields; feet large, broad; the toes very long, rather slender, with a wide web to the base of the claws; the outer edge of the fore leg and foot, and the hinder edge of the hind leg and foot, with a broad thin fringe, covered with large smooth plates; the claws 4—5, elongated, acute; tail short, thick, angular, the upper surface flat, granular, with a ridge on each side of the base converging towards the centre, where the ridges unite and form a single central ridge of granules to the horny tip of the tail.

This genus has all the characters of the more typical aquatic Terrapins. The feet are broad, the toes elongated and well webbed; and the alveolar edges of the jaws, according to the figure of M. A. Duméril (*l. c.* t. 15), have distinct dentated ridges, like the genera *Pseudemys* and *Batagur*. M. Duméril's figure seems to have been taken from a badly preserved stuffed specimen. There is a second specimen of this very interesting Terrapin now alive in the Zoological Gardens.

In my description of the genus I have described the axillary and inguinal plates as absent. In Mr. Salvin's specimen they are very small, but yet distinctly present, but are more developed on one side than on the other, showing that they are variable in this animal.

Description of the New Lizard (Spatalura Carteri, Gray), from Life*. By Henry Carter, Esq.

"Noticing that, in your specific description of *Spatalura Carteri* (Annals, vol. xiii. p. 249), you have inserted in a parenthesis the words 'dry from spirits,' I am inclined to think that you would be glad of more information on the colour-markings of this Lizard when

* Extracted from a letter to Dr. J. E. Gray.

fresh, which the following extract from my MS. Journal, written when the animal was caught, will, I hope, afford:—

"'Ground cinereous, six pairs of white spots between the back of the head and root of the tail, symmetrically placed; six to eight lines of red spots on each side, broken and terminating in small points towards the belly; buff-coloured irregular spots on the sides among the red lines; belly bright yellow, passing into cinereous towards the roots of the posterior and anterior extremities; legs and tail spotted with red towards their proximal ends, with white spots towards their extremities; head irregularly marked with red and white spots having a transverse direction. Iris light cinereous, tympanum sunken and covered with loose skin.'

"This is a homely description, but I give it to you *verbatim* as it is in my Journal, and am sorry that I had not the latter to refer to in London when I left you the specimen.

"Lastly, I notice, p. 250, in the fifth paragraph from the top, *l. c.*, that an error has crept into my statement, in the word 'Anthropophagi,' which ought to have been 'Chelonophagi' (Turtle-eaters). It will not do to make mistakes of this kind; and these poor people, degraded as they are, I trust will never come to this."

MISCELLANEOUS.

The Gare-Fowl, or Great Auk (Alca impennis).

To the Editors of the Annals of Natural History.

Gentlemen,—The September Number of your valuable Journal contains a list, communicated by Mr. Robert Champley, of the specimens of *Alca impennis* preserved in the various museums. To render this list more complete, I beg to inform you that a specimen of this rare bird is also contained in the Imperial Museum of Vienna.

Requesting the insertion of this note in your pages,

I remain, respectfully yours,

A. von Pelzeln,
Assistant Keeper in the Imperial Zoological Museum.

Vienna, Oct. 3, 1864.

[We omitted to remark, on publishing Mr. Champley's list of specimens of this species in our September Number (p. 235), that it seems to be very defective. Mr. Alfred Newton, in his communication to the Zoological Society, reprinted in our August Number (p. 140), states that "sixty-three or sixty-four stuffed skins" (*more than double the estimate* of Mr. Champley) are known by him to exist. Again, in the Appendix to Mr. S. Baring-Gould's 'Iceland' (p. 406), which was noticed in our pages (Annals, vol. xii. p. 396), Mr. Newton says he can enumerate fifty-nine eggs of this bird, adding, "there must be several besides, of which I have as yet no knowledge."—Eds.]

Observations on the Structure of Amœba *and* Actinophrys.

At a recent meeting of the Boston (U. S.) Society of Natural History, Dr. J. Wyman gave an account of some observations which he had recently made on an *Amœba.*

The species referred to appeared in some fibrine which had been confined between two plates of glass for the purpose of watching the progress of its decomposition in water. The *Amœbæ* were first noticed as minute points, and gradually grew to full size, without any obvious change of form or structure. As seen under the microscope, they appeared to be made up of a spherical sarcodic mass, which was structureless, and in which were imbedded numerous granules, from which last, however, a portion of the circumference of the organism was wholly free. Solid bodies, lodged in the interior, were seen to be discharged at various points in the circumference, seeming to meet with little or no obstruction; and yet no *opening* was discovered at any point. When the body to be discharged came near the surface, the sarcode was pushed out before it, becoming more and more prominent outwards, and at length broke like a bubble, leaving the contained body free.

The *Amœba,* in one instance, underwent complete spontaneous division in five minutes; first taking on the shape of a dumb-bell, then the two principal masses receded from each other, the band which united them became thinner, and finally broke, just as does the thread which connects two viscid bodies when drawn apart, and two complete *Amœbæ* were formed. In another instance, the division had become nearly complete, as just described; but the two masses, instead of separating wholly, again approached each other, and nearly recovered their original shape.

From the manner in which solid particles pass through these structures, and the rapidity with which the whole organism becomes subdivided, it is reasonable to infer that they have no proper integument, especially as the microscope fails to reveal such a structure.

Prof. Henry James Clark said that *Actinophrys* was particularly interesting, as manifesting a step higher than the simple homomorphous organization of *Amœba* as described by Prof. Wyman. Prof. Clark referred to Kölliker's observations in 1849, as recorded in the 'Zeitschrift für wissenschaftliche Zoologie,' and showed that, even supposing Kölliker to be correct, the division of the mass of the body into an exterior and interior portion, the former containing much larger vacuoles than the latter, indicated a heteromorphous organization, tending towards specialization of parts. He also added that he could not agree with Kölliker that *Actinophrys* is a homomorphous mass with vacuoles, but that he was convinced that the so-called vacuoles of the outer and inner layers are true cells, with a distinct wall about them, a wall that could be easily recognized with the help of the better sort of microscope-objectives of the present day. Owing to the exceeding transparency of the organism, no ordinary objective will show the walls; but with a one-quarter-inch lens, of one hundred and fifty degrees angular aperture, made for him, last June, by Tolles, of Canastota, N. Y., he had no difficulty in working, with

the proper adjustment and corrections, through a sufficient depth of water to completely cover the *Actinophrys* (*A. Eichhornii*), and could readily detect the walls, not only of the superficial cells, but also of the innermost ones *.

What is remarkable, too, the pseudopodia, as frequent and careful observations have led him to determine, invariably alternate with the cells of the exterior layer; that is, they are prolongations of the intercellular amorphous substance of the body. This fact would seem to add to the proof that the so-called vacuoles are really cells; otherwise it would be hardly credible that simple vacuoles, which come and go in an amorphous substance, should always alternate with the pseudopodia.

Sometimes a pseudopod moves very rapidly, especially when it has seized upon some victim; for then it retracts with a sudden jerk, and draws the prey close to the body, which finally engulfs it in the same manner as does *Amœba*. The pseudopodia exhibit an adhesive power which is remarkable when we consider the size of the animals which are sometimes drawn in by them, and in this respect remind one of the "adhesive vesicles" in the anchors of *Lucernariæ*, which hold fast to bodies with the greatest tenacity, and, to all appearances, by simple contact, just as glue and mucus adhere to anything which touches them. [See Prof. Clark's paper "on *Lucernaria*, the Cœnotype of Acalephæ," Proc. Bost. Soc. Nat. Hist. vol. ix. (1862) p. 52, and also reprinted, "with additions and notes," in the 'Annals of Natural History,' July 1863, p. 19.] In a *Difflugia* (very near *D. proteiformis*), Prof. Clark had observed that whenever the pseudopodia contract, they invariably become strongly wrinkled transversely; and, as he could not detect the least trace of an envelope or wall-like layer on this part of the body, he believed that the wrinkling is peculiar to the substance of the pseudopodia.

[In connexion with this, I will take the opportunity to assert that,

* [The unprecedented working distance which accompanies the great angle of aperture in the above-mentioned lens prompts me to speak more fully of its excellence. It has been the chief desideratum of naturalists to obtain a large increase in the working distance of those lenses which have a great angle of aperture; but hitherto the latter condition has seemed to involve necessarily an excessively short working distance, and consequently great inconvenience in the investigation of all bodies which are not correspondingly thin. The idea of studying marine animals in their native element with such lenses could never be indulged in, for fear of ruining the objectives by contact with salt water. At last we are relieved from this restraint; for within the last four or five years a great improvement has been made in this respect by opticians, at least by Mr. Tolles. The most recently constructed lens which I have received from that gentleman was made last June; it is a one-quarter-inch objective, with an angular aperture of *one hundred and fifty degrees*, and a most unexpected working distance of *one-fiftieth of an inch* for uncovered bodies. By experiment, I also find that it works through a glass covering fully *one-fortieth of an inch thick*, and with some room to spare above that. The working distance through water I have not measured accurately; but that can be inferred from the difference between its refraction and that of glass. The defining power of this lens is certainly unsurpassed, if not unequalled.—H. J. C.]

from a number of observations on various animals, I have been led to the conclusion that *all vibratile cilia originate in the amorphous intercellular substance.* In no instance have I ever seen vibratile cilia forming direct prolongations of cells, but invariably I find their bases imbedded in the intercellular cytoblastema. They may seem to be prolonged from the underlying cells; but, on the contrary, as I have particularly satisfied myself in regard to the branchiæ of the oyster (*Ostrea virginiana*), they are based in the cytoblastema, which extends in a thin stratum over the outer ends of the cells. In other instances they alternate with the cells, projecting in rows between them, and forming, as it were, a bristling corona to each cell, as I have seen in the epithelium of the intestine of the young Snapping Turtle (*Chelydra serpentina*). In the latter instance, when the cells are loosed from the intestine, they carry the overlying cytoblastema with them, and consequently, also, the vibratile cilia, which then falsely appear like appendages of the cells themselves. The nettling cells (*cnidæ*) of Polypi and Acalephæ originate in the same substance (the intercellular cytoblastema) as do vibratile cilia. They have been supposed to *develope within the cells* of the layer in which they are situated; *but this is not true.* Oftentimes, when cnidæ are removed from their basis by pressure, they drag along with them a portion of the cytoblastema, which encloses them like a transparent envelope, and has the appearance of a cell. Sometimes three or four cnidæ are pressed out together, and, being covered by the accompanying cytoblastema, they present the deceptive appearance of several cnidæ in one cell.

There are four periods in the history of cnidæ. Wagner (Wiegm. Archiv, 1835) was the first to detect the existence of these bodies; but he mistook them for peculiar forms of spermatozoa of *Actinia Cereus*). Immediately after this, if not at the same date, Ehrenberg (Abhandl. Berlin Akad. 1835, Jahrg. [1837] p. 147) recognized their true office, and described them as the prehensile organs (Fangangeln) of Hydra. Yet in 1842 (Wiegm. Archiv) we find him inclined to deny that they have *stinging* properties, such as Wagner attributes to those which he found in *Pelagia noctiluca.* In 1841 (Wiegm. Archiv, p. 38) Wagner described the nettling-organs (Nesselorgane) of *Pelagia noctiluca*; and although he detected the spirally-rolled thread in the capsule, and says of the thread, "sometimes it appears as if it had a canal," and figures it so in his 'Icones Zootomicæ' (1841, pl. 33. fig. 9 B), yet it was reserved for Doyère, in the latter part of the next year (Comptes Rendus, Aug. 1842, p. 429, "Note sur quelques points de l'Anatomie des Hydres d'Eau douce"), to describe the mechanism of the cnidæ, and the mode of evolution of the thread, with such completeness as to anticipate everything in this regard that has been published since, up to the year 1860, when I figured and briefly pointed out (in Agassiz's 'Contributions,' vol. iii. pl. 11^{b}. fig. 16^{a}, *Aurelia flavidula*, and description of plate, p. 17, and pl. 11^{c}. fig. 5, *Coryne mirabilis*) an as yet undescribed relation of the thread to the cell in which it is coiled up. As the brilliant discovery of Doyère has been kept in comparative obscurity, at least in America, I will quote from his paper such

passages as will make it clear that he deserves the credit which has been assumed by those who have merely *repeated his observations.* On page 430, 'Comptes Rendus,' he says, "Ainsi le *spicule* ou *dard*, figuré dans l'intérieur du sac par M. Corda (*calcarea sagitta*, Corda), et représenté saillant au dehors par M. Ehrenberg, dans sa planche 2. fig. 7 *b*, n'est autre que l'espèce de calice basilaire à trois points en étoile, des prétendus hameçons. Le long filament grêle qui part de ce calice étoilé était, avant l'évolution, invaginé en dedans de lui-même et du calice ou spicule par un *retournement en doigt de gant*, et formait au fond du sac cette apparence de coussin que M. Corda a nommé *vesica patelliformis*; un examen attentif et d'excellents instruments font même reconnaître dans ce coussin sa composition par un fil enroulé en spirale." On page 431 he speaks of the evolution of the thread of this and another smaller nettling-cell by *ensheathing itself*: "des corpuscules plus petits et surtout beaucoup plus étroits que les précédents, ovoïdes, à parois épaisses contenant à leur intérieur un fil enroulé en spirale, qui sort comme le long filament des hameçons, en s'engaînant en dedans de lui-même." All that I have been able to add to this, although the subject has been pursued with the utmost rigour, and with the best lenses to be had, is the description of the relation of the coiled thread to that part of its base which projects straight into the cavity of the cell. Perhaps the greatest importance that can be attached to this is that it is the most difficult to make out. However, the discovery of this feature solves the whole mechanism of the organ. Although I had, in 1860, figured and briefly indicated (Agassiz's 'Contributions' *ut suprà*) this part of its structure, yet it was not until the fourth volume of the 'Contributions' appeared, in 1862, that I described it, in full, as I had seen it in various animals, viz. in the ephyra of *Aurelia flavidula* (p. 44), the Hydra form of *Coryne mirabilis* (p. 209), *Actinia marginata* (p. 210), and *Hydractinia polyclina* (p. 237). At first sight, I might seem to be anticipated in this by Gosse, in his 'Evenings with the Microscope,' London, 1859, or in his 'Actinologia Britannica,' London, 1860, p. xxix, Introduction, and pl. 11. fig. 6; but, upon examination of the illustration, I find nothing to justify it; and, from the description in connexion with the figure, I should judge that the cnidæ had been injured and distorted by pressure. However, I leave it to others to decide whether Gosse's description is sufficient to clear up the subject on this point.

Among the Ctenophoræ the cnidæ are so numerous and so closely packed together, as to form a uniform layer all over the surface of the tentacle totally outside of the exterior wall.—H. J. C.]

On the Writings of C. S. Rafinesque.

To the Editors of the Annals and Magazine of Natural History.

Gentlemen,—Will you allow me to state, for the information of your readers, that a long-desired work is about to be accomplished in Philadelphia, namely, the reproduction of the complete writings of Constantine Smaltz Rafinesque on Recent and Fossil Conchology, to be edited by W. G. Binney and G. W. Tryon, Jun. This indus-

trious naturalist, first established in Sicily, and four of whose works on the natural history of that island were published at Palermo in 1810–1815, removed, about the year 1817, to the United States. During his residence there, he worked assiduously on the natural history of the States, which were almost virgin ground—chiefly the plants and fishes. As yet, none of their famed river mollusks had been described, and M. Rafinesque sent to Europe in 1820, for publication in the 'Annales Générales des Sciences Physiques' of Brussels, a paper entitled "Monographie des Coquilles bivalves fluviatiles de la rivière Ohio, contenant douze genera et soixante-huit espèces." Here is an instance in which as many as sixty-eight species of the North-American river shells, including all the principal species, were described for the first time, so recently as 1820, in a work of scientific authority; and yet they have been passed over by American writers as not being sufficiently clear for identification. But if the descriptions of the whole sixty-eight are not clear enough, there can be no mistake about the majority of them; and I am happy to say that, in a monograph of the genus *Unio* (now in course of publication in the 'Conchologia Iconica'), I hope, with the assistance of Mr. Anthony, of Cambridge, Massachusetts, to succeed in restoring the priority of most of M. Rafinesque's names.

I have been led to offer this communication, not only for the sake of making the acceptable announcement of the forthcoming publication of Messrs. Binney and Tryon's reprint, but with the view of upholding an important principle in nomenclature, which appears to be much too readily cast aside. In Mr. P. P. Carpenter's paper "On Mollusca of the West Coast of North America" (Brit. Assoc. Reports for 1863, p. 677) occurs the following passage:—

"It is unfortunate that in the two most important branches of North-American freshwater mollusks, the Melaniadæ and the Unionidæ, there exists a radical difference of opinion between the leading writers, which has sometimes assumed the appearance of personal animosity. Malacologists east of the Atlantic, unwilling to become partisans where the leading nomenclators of the rival schools are equally honoured, have to a great extent declined to pay attention to the unexhausted riches of the American waters, regarding any settlement of the disputed points as hopeless. Dr. Isaac Lea, who has spared no expense in illustrating his publications of the results of a lifelong study, follows the restrictions on the priority-rule allowed by the British Association Committee. Other writers, however, claim a certainty in identifying the supposed species of Rafinesque and other similarly inaccurate authors, which would be considered by most English naturalists as not warranted by the few loose words of description given. It would be well if the student were permitted to start from the first carefully ascertained land-mark, rather than from the defaced tracks of the first hunter."

On the principle involved in this passage, many of the tracks of the hunter Linnæus must be regarded as being defaced, and probably one-half of the species of the 'Systema Naturæ' would have to be set aside. I am, Gentlemen, your obedient Servant,

Sutton, Heston, Oct. 2, 1864. LOVELL REEVE.

On Psalidostoma, *a new Genus of Fishes of the Family* Characini. By Professor Kner.

This genus is remarkable partly from the character of its dentition and partly from the mobility of its jaws. In the latter respect it reminds us of *Hemirhamphus, Belonesox,* and *Panchax,* and consequently forms a transition between the *Characini* and the *Scomberesoces* and *Cyprinodontes*; it is upon this character that the author has founded his generic name *Psalidostoma* (Scissors-mouth). The generic characters are as follows:—

Genus Psalidostoma, Kner.

Corpus elongatum (*Esociforme*); caput depressum, subacutum, oris rictus amplus; ossa supra- et infra-maxillaria forcipis ad instar mobilia (in *Hemiramphi* modum); ubique dentes canini validi in medio, ad latera vero dentes uniseriales breves lobati; retro hos in ambis maxillis fascia mediana trigona dentium velutinorum. Pronotum carinatum; abdomen rotundatum; pinna dorsalis retro $\frac{1}{2}$ corporis longitudinem et pinna ventralis inchoans; pinna adiposa supra pinnæ analis finem sita. Caput nudum; squamæ trunci ctenoides, linea lateralis continua; radii branchiostegi 4; pseudobranchiæ nullæ.

Of the only known species two examples, measuring rather more than seven inches in length, have been sent by Consul Binder from the White Nile. The author proposes for it the name of

Psalidostoma caudimaculatum, Kner.

D. 16, A. 15, V. 9, P. 14, C. 19

Capitis longitudo $\frac{1}{4}$, corporis altitudo $\frac{1}{6}$ longitudinis totalis partem constituens; pinna caudalis lobata, fusco-nigro punctata.

From the White Nile.—*Bericht der Acad. der Wiss. in Wien,* June 23, 1864, p. 110.

Observations on the Development of Raia Batis. By Jeffries Wyman, M.D., Hersey Prof. Anat. in Harvard College.

These investigations by Dr. Wyman were made on a series of eggs collected in the spring of 1851 and of the three subsequent years. The more important conclusions arrived at are stated as follows at the close of the paper:—

(1.) The yelk-case is formed in the glandular portion of the oviduct, and is begun previously to the detachment from the ovary of the yelk which is to occupy it.

(2.) The embryo, before assuming its adult form, is at first eel-shaped and then shark-shaped.

(3.) The embryo is for a short time connected with the yelk by means of a slender umbilical cord; the cord afterward shortens, and the young skate remains in contact with the yelk until the end of incubation.

(4.) There are seven branchial fissures at first: the foremost of these is converted into the spiracle, which is the homologue of the Eustachian tube and the outer ear-canal; the seventh is wholly closed up, and no trace remains; the others remain permanently open.

(5.) There are no temporary branchial fringes or filaments on the

first and seventh arches; on the others the fringes are developed from the outer and convex portion of the arch, and are not at first prolongations of the internal gills.

(6.) The nostrils, as in all Vertebrates, consist at first of pits or indentations in the integuments; secondly, a lobe is developed on the inner border of each; and, finally, the two lobes become connected, and thus form the homologue of the fronto-nasal protuberance. The transitional stages of these correspond with the adult conditions of them in other species of Selachians.

(7.) The nasal grooves are compared with the nasal passages of air-breathing animals, and the cartilages on either side of these to the maxillary and intermaxillary bones.

(8.) The foremost part of the head is formed by the extension of the facial disk forward. While this extension is going on, the cerebral lobes change their position from beneath the optic lobes to one in front of them.

(9.) Two anal fins, one quite large and the other very small, are developed, but both are afterwards wholly absorbed.

(10.) The dorsals change position from the middle to the end of the tail. At the time of hatching, however, there is still a slender terminal portion of the tail, which is afterwards either absorbed or covered up by the enlarged dorsals, as they extend backward.—*Memoirs of the American Academy*, vol. ix. pp. 31–44.

On Dimorphism in the Hymenopterous Genus Cynips. By Benjamin D. Walsh, M.A.

The Cynips studied by Mr. Walsh make galls on a species of oak, the *Quercus tinctoria*. Part of these galls produce males and females of the *Cynips spongifica* in June. Another portion of them, of wholly similar general character, remain green till autumn, and produce in October and November, and also in the following spring, another form of Cynips—the *Cynips aciculata*, hitherto regarded as a distinct species, all the individuals of which are *females*. Mr. Walsh appears to prove that the latter, although widely different in many characters, is only another form of the *C. spongifica*, and thence that this species is dimorphous. The individuals produced in June live but six or eight days; what place in nature, then, the author asks, is filled by the *C. aciculata*? In reply, he suggests, from the analogy of *Apis*, *Bombus*, &c., that "the female *aciculata* generates galls, which produce by parthenogenesis male *spongifica*, and that the females and males of the latter, coupling in June, oviposit in the same month, in the young buds of the oak, eggs that remain dormant till the following spring, some of which then produce *female spongifica* in June and some *female aciculata* in the autumn or early in the following spring, and these last, in their turn, generate *male spongifica* to appear in the following June." He continues, "It may also be the case that some few male *spongifica* are generated by female *spongifica*." The author next sustains this opinion by mentioning some of the analogies that have been observed in other Hymenopterous insects.—*Proceedings of the Entomological Society of Philadelphia*, March 1864, pp. 443–500.

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XLIII.—*New British Lichens.*

By the Rev. W. A. Leighton, B.A., F.B.S.E.

[Plate IX.]

Thelocarpon, Nyl.

Apothecia granuloso-verruciform, ostiole punctiform. Nucleus gelatinous, colourless. Perithecium subceraceous. Paraphyses slender, flexuose. Asci ventricoso-fusiform. Sporidia innumerable, minute, ellipsoid, hyaline, with an indistinct nucleus at each extremity. Thallus thin, crustaceous.

Thelocarpon Laureri (Flot.). Thallus crustaceous, somewhat furfuraceous, thin or evanescent, brownish grey; apothecia scattered, minute, granuloso-verrucose, of a citrine-yellow colour; ostiolum slightly depressed, inconspicuous; sporidia in ventricoso-fusiform asci, numerous, minute, ellipsoid, obsoletely polarinucleate, hyaline.

Sphæropsis Laureri, Flot. in Bot. Zeit. 29 Jan. 1847, p. 65.
Thelomphale Laureri, Flot. in lit. (1848) fide Körber, Par. Lich. p. 321; Körber, Par. Lich. 321 (1863).
Thelocarpi, sp., Nylander, Classif. i. 15 (1854).
Thelocarpon Laureri, Nylander, Lich. Algerie, p. 338 (Aug. 1854); Nyl. Classif. ii. p. 190 (June 1855); Nyl. Prodr. p. 173 (1857); Nyl. Pyrenocarp. p. 10 (1858); Nyl. Enum. p. 135 (1858); Leight. Lich. Brit. Exsic. fasc. xii. 351 (1864).

Thallus (or what appears to be such) very thin, crustaceous, either uniform or not unfrequently breaking up into furfuraceous flakes, then becoming scattered, and often evanescent, of a dirty or brownish-grey colour. *Apothecia* very minute, apparently primarily emerging gradually from the thallus, ultimately sessile and enlarged, irregularly scattered, globular, of a citrine yellow colour. The exterior coat of the apothecium appears to be formed of large, rounded, citrine-coloured cells, each containing several round gonidia, and, under the microscope, presents a slightly

roughened or minutely papillate appearance, arising from the chinks which separate the large gonidia-cells from each other. No true *ostiolum*, as in *Verrucaria* and *Endocarpon*, could be detected; but, under a low power of the microscope, the apical surface of the wart-like apothecium presents a roundish, pale-brown, depressed spot. Under a higher power, this appearance is found to be caused by the cells of the external coating becoming more scattered and distant from each other, or being irregularly removed or absent altogether, and permitting the inner coat or perithecium to be visible underneath; then, in some instances, a very minute rounded brown dot becomes visible, which in all probability is the ostiolum; but no pore could be defined. The inner tunic, or *perithecium*, is of similar but paler citrine colour with the exterior coating, and is formed of smaller and more compacted cells, presenting a somewhat waxy structure. The *nucleus* is pale and white, filling the perithecium. When gently pressed out of the perithecium, the asci and paraphyses are seen to grow in a stellate or radiate manner from a spot at the inner base of the perithecium. *Paraphyses* very slender, either erect or flexuose and entangled, presenting more or less of a beaded appearance, as if hollow and having minute yellow globules scattered at intervals singly in the interior. *Asci* of an elongated ventricose or fusiform shape, tapering towards the apex, distended in the middle, and suddenly contracted at the base into a narrow stalk, filled with innumerable minute sporidia, which I have seen issue from the little base of the ascus (when wounded, I presume,) in feeble intervallated jerks, conglutinated into a narrow riband or thread. *Sporidia* very minute, narrowly oblong or ellipsoid, either straight or irregularly curved, unilocular, hyaline, with an indistinct minute nucleus at each extremity, about two and a half times as long as broad.

This curious and very remarkable Lichen I discovered on a single decorticated larch rail at Middletown, near Craig Breiddin, Shropshire, June 6, 1864. Afterwards (August 4, 1864) I again met with it, on the Stiperstones Hill, Shropshire, growing parasitically on the thallus of *Bæomyces rufus*, Ach., in company with *Lecidea citrinella*, Ach., var. *arenicola*, Nyl., and (Aug. 10, 1864) on larch rails of the railway-fence near the Cemetery, Shrewsbury. In all these localities it occurred in very small quantity, and subsequent repeated researches have hitherto failed to detect more of it. Its extreme minuteness has been, no doubt, the cause of its having been heretofore overlooked; but now that attention has been drawn to it, it will most probably be found to be not uncommon.

It most resembles at first sight the granules of the thallus of *Trachylia tigillaris*, Fries, in a young scattered state, or has

somewhat the appearance of the thallus of *Lecidea citrinella*, Ach., or even of the undeveloped apothecia of a *Lecanora*; but the microscope and dissection show such appearances to be mere resemblances.

Thelocarpon Laureri was first discovered by Flotow, in 1824, in marshy places in the county of Glatz, Germany; and his specimens appear to have lain in his herbarium undetermined until 1846, when M. Laurer again found the lichen on turf fences at Greifswald, and then drew M. Flotow's attention to it. Flotow then described it, under the name of *Sphæropsis*, in the 'Botanische Zeitung,' 1847, p. 65, with this character:—
"*Sphæropsis*, Fw. (Verrucarieæ, Porineæ).—*Apothecium* verruciforme, ostiolatum, e thallo formatum, includens *nucleum* solitarium gelatinosum achromaticum. *Perithecium* proprium nullum. *Asci* basilares ventricoso-fusiformes; *sporas* minutas ovales numerosissimas hyalinas foventes.

"*Sphæropsis Laureri*, Fw.—*Sph.* hypothallo inconspicuo, crusta granuloso-verrucosa, flavo-viridi; verrucis acolytis plus minus confertis, fertilibus ostiolo impresso nigricante. Habitat ad aggeres turfosos (Greifswald, *Laurer*, 1846) et in ericetis humidis (Grafschaft, Glatz, 1824). *Fw. herb.* 1824, n. 285."

Soon after, however, discovering that the name *Sphæropsis* had been already appropriated to a genus of Fungi, M. Flotow, in his letters (in 1848) to various botanical correspondents, changed it to *Thelomphale*. Dr. William Nylander, apparently without knowing of Flotow's change of name, described another closely allied species from Algeria (*T. albidum*, Nyl.), in 1854, altering the generic name to *Thelocarpon*, which he has retained in all his subsequent works. Körber, in the 4th part of his 'Parerga Lichenologica,' published in 1863, relates the circumstances of Flotow's early change of the name to *Thelomphale*, which he himself adopts. Nevertheless Nylander's name *Thelocarpon* has priority of publication, and must, of course, be adopted.

Only three species of the genus are known: *T. Laureri*, Fw., in Germany and England; *T. albidum*, Nyl., with white thallus and uniseptate sporidia, in Algeria; and *T. coccophorum*, Mntg., in Chili (apparently a doubtful species).

Dr. Körber has compared our plant with his authentic specimen, and finds them identical. Dr. F. Arnold, of Eichstätt, informs me that the German habitat is now destroyed.

Plate IX. fig. 1. Plant, magnified 20 times.
fig. 2. Vertical section of apothecium.
fig. 3. Asci and paraphyses in stellate form.
fig. 4. Ascus and paraphyses.
fig. 5. Sporidia, magnified 1200 times linear.

Lecidea Caradocensis, Leight. Thallus cartilaginous, dull grey-greenish olive, rimoso-areolate, granulato-verrucose; scales convex, crimped or wrinkled; apothecia dull black, sessile on the areolæ, more or less imbedded; sporidia elliptico-fusiform, 3-septate, hyaline.

Lecidea Caradocensis, Leight. Lich. Brit. Exs. 160! (1854); Nylander, Prodr. Lichen. p. 137 (1857); Enum. Lich. p. 126 (1858).

Discovered by me in 1854, in great abundance, growing with *Lecidea ostreata*, Hoffm., on oak palings surrounding the south and west bases of Caer Caradoc, Shropshire. Aymestry!, Herefordshire (1864), *Rev. J. F. Crouch.* North side of Gopsall Wood!, near Twycross, Leicestershire (1864), *Rev. A. Bloxam.*

Thallus cartilaginous, moderately thick, forming often large, diffused, irregular patches, of a pale grey-greenish olive-colour, rimoso-areolate, consisting of minute, adnate, roundish, convex, smooth scales, rounded or more or less minutely crenulate at the margins, densely crowded and aggregated closely together, so as to present a crimped or wrinkled granulato-verrucose appearance, generally smooth, but, when rubbed, becoming somewhat pulverulent. *Apothecia* sessile on the areolæ, often appearing more or less deeply imbedded, by reason of the thalline scales forming a prominent crimped border around them, very small, numerous, single, or more frequently crowded, confluent, and difformed. *Disk* flattish, of a dull brownish-black colour. *Margin* thin, irregular, and very flexuose, slightly prominent, and more or less incurved, of the same colour as the disk. *Paraphyses* closely conglutinated into a brown mass. *Hypothecium* dark brown. *Asci* inconspicuous. *Sporidia* minute, elliptico-fusiform, 3-septate, hyaline, the number not ascertained.

PLATE IX. fig. 6. Vertical section of apothecium and thallus.
fig. 7. Sporidia, magnified 1200 times linear.
fig. 10. *L. Caradocensis*, natural size.

Lecidea Friesii, Ach. Thallus cartilaginous, brownish olive, diffuse, glebuloso-squamulose; scales convexo-gibbous, smooth and polished; apothecia black, prominently sessile on the scales; sporidia ellipsoid, simple, hyaline.

Lecidea Friesii, Ach. in Liljebl. Sv. Fl. p. 610 (1816); Nyl. Scand. p. 243 (1861).
—— *myrmecina*, Fr. in Vet. Ak. Handl. p. 257 (1822); Lich. Eur. p. 344 (1831); S. V. S. p. 114 (1846); Exs. 28; Nyl. Prodr. p. 136 (1857); Enum. p. 126 (1858).
Psora Caradocensis, Mudd (non Leight.), Mudd, Man. p. 169, t. 3. f. 61 (excl. syn.) (1861); Exs. 142!

On old oak-trees and stumps. Farndale! Stogdale! Kildale! Baysdale! (in the latter locality mixed with *Lecidea ostreata*, Hoffm.); all in Cleveland, Yorkshire; *Mr. W. Mudd.*

Thallus cartilaginous, growing scattered or in larger or smaller irregular patches, of a pale brownish olive-colour, consisting of moderate-sized, smooth, polished scales, adnate and flattened when growing scattered, with a margin more or less deeply incised, the lobes minute, rounded, entire or crenate; when growing crowded, the scales are convex and gibbous, more or less imbricated, giving a glebulose or coarsely verrucose appearance. *Apothecia* prominently sessile on the scales, small, numerous, most generally crowded together, confluent and difformed. *Disk* flattish, roughened, of a very dark brownish black, slightly polished. *Margin* moderately thickened, irregular, and very flexuose, prominent, and incurved, of the same colour as the disk and slightly polished. *Paraphyses* conglutinated into a brownish mass. *Hypothecium* dark brown. *Asci* inconspicuous. *Sporidia* very minute, ellipsoid, simple, hyaline, their number not ascertained.

Specimens in my herbarium, on pine-wood bark, from Dr. Th. M. Fries and Dr. Wm. Nylander, collected at Upsal, and both apparently identified with Fries's Lich. Suec. 28, have the thalline scales of a richer brown colour than our British specimens, but correspond in the above characters and microscopical details.

Not to be confounded with *L. ostreata, β myrmecina* (Ach. & Wahl.), from which the convexo-gibbose non-ascending scales keep it distinct, nor with *L. Caradocensis*, Leight., distinguished by different sporidia (omitting other characters from both).

PLATE IX. fig. 8. Vertical section of apothecium and thallus.
fig. 9. Sporidia, magnified 1200 times linear.
fig. 11. *L. Friesii*, natural size.

I would avail myself of the opportunity of stating that Dr. W. Nylander informs me by letter (Oct. 1864) that my *Opegrapha anomala*, described and figured in 'Ann. & Mag. Nat. Hist.' Feb. 1857, proves to be identical with *Graphis Ruiziana*, Fée.

XLIV.—*Memoir on the* Pranizæ *and* Ancei. By M. EUGÈNE HESSE*.

ACCORDING to an observation made by the author twelve years ago, and communicated by him to the Academy of Sciences in 1855, the *Pranizæ* and *Ancei*, instead of forming two distinct groups of Crustacea, are to be regarded as developmental phases of the same form, the *Pranizæ* being only *Ancei* in a larval state. On the 29th of August 1852, he obtained from a Gurnard (*Trigla Hirundo*) a *Praniza*, which, having to leave home for a

* Abstract from a separate impression of the memoir published in the 'Mémoires présentés à l'Académie des Sciences.' Communicated by the Author.

few days, he preserved alive in sea-water, instead of putting it into spirits. On his return, he found its place occupied by an *Anceus*. From the difference of form, especially in the size of the head, he thought that he must have fallen into some error; but subsequent observations confirmed his first view of the relations existing between the two forms. On the 20th of July 1853 he found a *Praniza* on the fins of a Plaice (*Platessa vulgaris*), which became an *Anceus* on the 5th of November. On the 19th of August 1855, three *Pranizæ* were found on the body of a red Gurnard (*Trigla Pini*); these were transformed into *Ancei* on the 1st of September. On the 21st of September 1856, several *Pranizæ* were taken on a Gurnard (*T. Hirundo*), and became converted into *Ancei* on the 8th of October. On the 10th of June 1857, he found under stones, on a somewhat muddy part of the shore, a great number of *Pranizæ* intermixed with male and female *Ancei*. In a few days all the *Pranizæ* underwent their metamorphosis, "so that nothing but *Ancei* remained." And on the 29th of August 1857, he found twenty-one *Pranizæ* in the mouth of a Wrasse (*Labrus Bergylta*), which all became transformed into *Ancei* on the 6th of September and following days.

In all cases, since this period, the *Pranizæ* met with by the author have undergone the transformation above described, and the *Ancei* thus produced have copulated and produced fertile ova, the first products of which were *Pranizæ*. The cast skins of the *Pranizæ* were also found at the bottom of the vessels in which they were preserved, and their examination has enabled the author to elucidate the structure of the mouth in these Crustacea. The facts observed by the author demonstrate that the Crustacea hitherto described under the generic names of *Praniza* and *Anceus* must now be regarded as forming one genus, for which the latter name must be retained, as it is only in the *Anceus*-form that they are capable of reproduction.

Of the general characteristics of the *Ancei* M. Hesse speaks in the following terms :—"Of all the Crustacea inhabiting our coasts, there are certainly none more worthy of attracting the attention of naturalists than the *Pranizæ*, or rather the *Ancei*, whether we consider the brilliancy and variety of their coloration, the lightness and elegance of their forms, or the singularity of their mode of life ; but, for the present, I shall confine myself to speaking of the transformations which they undergo, from their escape from the egg until they attain the perfect state. When these Crustacea, still in the *Praniza*-state, are superficially examined, we are struck by the resemblance they present to some insects of the order Coleoptera, especially of the family Carabidæ; but this analogy becomes still more striking when they have under-

gone their last metamorphosis and arrived at the state of *Ancei*; for then the thorax, divided into two distinct portions by a strongly marked constriction, simulates a sort of corselet at the fore part; greatly developed mandibles, resembling nippers, rival those of the *Scaritæ* and *Manticoræ*; lastly (and this is an extremely curious fact), these appendages, which are so exuberant in the males of the above insects, as in the males of our Crustacea, are wanting in the females of the latter—a character which, however, is not so absolute in the females of the Beetles above mentioned, as they have mandibles like those of the males, but comparatively of very small size; and, finally, some parts of the thorax present appearances of elytra, as in *Meloë*"*.

Metamorphoses undergone by the Pranizæ *at their escape from the Egg.*

Scarcely have the female *Ancei* arrived at their final state than their numerous eggs make their appearance in a large membranous pouch beneath the thorax. The eggs are of large comparative size, and of a spherical form; they are covered by a transparent and slightly rugose skin, through which a single vitellus may be seen; their incubation occupies from twenty to twenty-five days, but sometimes less, according to the season and the temperature.

In the first phase of development of the embryo, the mass of matter contained in the egg has a flattened oval form, showing at its superior extremity a dilatation divided into three lobes. The median lobe forms the frontal region, and the two lateral ones are the first traces of the eyes or antennæ, or perhaps of both. The various parts gradually advance towards perfection, the young *Ancei* remaining all the time firmly adherent to their mother, and protected by thoracic plates, which cover them until they are capable of seeking their own nourishment.

At this period the young *Ancei* have the head and limbs relatively very large; the head is triangular, convex above, and flattened beneath; the rostrum, which forms the apex of the triangle, is curved downwards. This *rostrum* presents, including a triangular frontal process which covers and consolidates the whole apparatus, four double symmetrical organs, namely—

1. Two large, flat mandibles, forming a pincer, denticulated at the extremities.

2. Two styliform appendages, likewise denticulated at the end.

3. Two opercular footjaws.

* This observation was already made by Mr. Westwood in 1832, Ann. Sci. Nat. t. xxvii. p. 331.

The *antennæ* are situated on the forehead, on each side of the rostrum. The *inner antennæ* generally reach only to the third joint of the outer ones. They consist of four joints and a terminal filament of three joints. The *outer antennæ* present four joints, with a terminal filament of seven joints. The *eyes* appear like diffused spots on the sides of the head. The *thorax* is cylindrical, and composed of five segments, exclusive of that forming the neck.

The *digestive apparatus*, which is very voluminous, is easily seen through the transparent skin; but the author could not trace the intestine to its inferior orifice; nor could he detect the circulation, except at the base of the abdomen upon the median line. He distinctly perceived the movements of the blood-globules in the branchial false feet: these globules are subject to a regular impulse from right to left. But in a female which, after the expulsion of her young, was as it were reduced almost to a mere skin, he was able to see that the globules of the blood are subjected to two opposite movements—namely, a median one towards the posterior extremity, and a lateral one directed forwards.

The globules are of equal size, of an oval form, and rather wide apart; they are subjected to a regular jerking motion, comparable to the movement of the second-hand of a watch; they are driven to the furthest extremities of the appendages, and here their motion appears to be more lively than at their centre. The impulsion of the *heart* is manifested throughout the median line, but is most sensible at the base of the thorax at its junction with the abdomen.

The *nervous* or *ganglionic* system is readily visible in young individuals, in consequence of their transparency. The thorax presents *six ganglia*, of which the first is cephalic, and the last forms the base of the penis. The ganglia are lozenge-shaped, and united by a double interganglionic cord, of which, however, the tubes are combined so as to leave no interval. Each ganglion emits on each side a very delicate nerve, which traverses the feet; and the nerves of the fifth pair of feet emit a branch, which descends from the base of the feet to the first abdominal segment.

The six *ambulatory feet* are composed of five joints, of which the first and last are the longest; the latter is terminated by a strong claw. In the youngest larvæ the first pair, attached to the sides of the neck, do not present this construction.

The *abdomen* likewise presents six joints, of which the first five are of equal size, and the sixth, which is usually larger, is of a triangular form. Each joint has a double pair of branchiæ or natatory feet: these are usually lamellar and ciliated, and at-

tached to a common peduncle. Besides the branchial feet, the sixth segment presents on each side, near its antero-lateral angles, a false foot with a very short basal joint, and with two terminal laminæ extended horizontally in the form of a caudal fin. In the young, the abdomen is generally nearly as broad as the thorax, and presents no constriction either at base or apex.

Structure of the Pranizæ *at the period of their transformation into* Ancei.

After their attaining the form just described, the *Pranizæ* undergo little modification of form: the antennæ, thoracic feet, and abdomen scarcely change; but the head and thorax are subject to some modification.

The *head* is remarkably small, distinct from the body, triangular in form, globular above, flattened below, and incurved at the apex. Seen from above, it appears to be clearly divided into three parts—namely, the *extremity of the rostrum*, the *rostrum*, and the *forehead*. The apex of the rostrum is conical and acuminated; it is formed by two mandibles, which are pointed, denticulated within, and incurved. The *rostrum* is enlarged in the middle, and narrowed towards its junction with the forehead, from which it is separated by a straight raised line, the extremities of which reach the base of the antennæ. The rostrum is traversed vertically by deep lines or grooves, indicating the union of five pieces; and besides these there are two lateral ones which embrace the former, and are soldered to them at the base, but free at the apex, which is pointed and recurved; from within these two laminæ issue the styles with denticulated apices, which are seen at each side of the extremity of the rostrum.

The *antennæ* (already described) are inserted at the base of the rostrum, in a notch which presents a rounded process; this is the *auditory tubercle*: the skin covering its extremity presents a sort of very close network formed of crossing lines.

The *eyes* are large and prominent, hemispherical, and composed of round facets; they are placed obliquely on the sides of the head. The *neck* presents three folds.

Seen from beneath, the *head* presents the same threefold division: the apex has nothing remarkable about it; but the two other parts contain the *buccal apparatus*. The mouth is closed in front by the first pair of *footjaws*, consisting of the inner branch, which is lamellar, notched at the apex, and terminated by two blunt points furnished with hairs. These footjaws have no palpi; their outer margins appear to be attached to the head in the manner of a hinge, as in the *Ancei*. The second and third pairs of footjaws, covered by those just described, form denticulated

styles which issue between the parts of the apex of the rostrum, and are probably employed in producing wounds from which the blood may flow. Behind the footjaws the lower part of the head exhibits a deep, longitudinal median fissure, which completes the mouth, and forms at its extremity a commissure destined to facilitate the introduction of fluids by suction. Below the mouth, in some individuals, there is a very prominent bilobed sac, forming a sort of crop, the office of which is unknown, although it appeared to contain food: its presence is the more remarkable as it occurs but rarely, and disappears when the Crustacean becomes converted into an *Anceus*.

The *thorax*, generally of an ovoid form, is equally convex above and below, and is covered with a transparent skin. It presents no well-marked segments, except the first and second, and sometimes the third, which are very distinct. The third segment is rarely entire; it is often indicated by two lateral pieces, different in substance from the skin upon which they are fixed, and which appear to be rudiments of the carapace. To these lateral pieces are united others, resembling the elytra of the Meloës and Hemiptera. Analogous pieces are also placed at the base of the other thoracic limbs, to which they serve as points of attachment; and, lastly, these are sometimes united by a sort of ridge, forming a narrow margin to this part of the body. The middle of the thorax, both above and below, presents vertical and transverse lines forming four divisions, of which the angles are truncated at the centre by a small lozenge-shaped piece; these lines probably indicate the part at which the skin is divided when the animals undergo their last transformation.

The *legs* present no peculiarities requiring notice, with the exception of the first two, which are fixed on each side to the base of the head, the apex of which they scarcely pass; they are armed with strong claws, which enable their possessor to adhere firmly to any object. These legs, which constitute the first pair of thoracic members, makes the number of these *twelve* instead of *ten*, as has hitherto been supposed; but they are wanting in the *Ancei*.

Structure of the male Ancei.

In the transformation of the *Pranizæ* into *Ancei*, the only parts which undergo no metamorphosis are the antennæ, the thoracic feet, and the abdomen. The *head*, on the contrary, shows the most extraordinary changes; from being very small, it acquires a volume at least equal to that of the thorax. From above, the head of the male *Anceus* is seen to be armed in front with two large moveable laminæ, generally falciform and denticulated on their inner margin, and elevated at the apex, so as to

resemble the curved scissors used by surgeons. These organs resemble the mandibles of insects, and appear to perform the same functions. The head, which is of a quadrilateral form, is divided into four equal parts by depressed lines which cut each other at right angles; the forehead is armed with three teeth, of which the middle one is generally small, acute or denticulated, and the lateral ones truncated at the apex and placed within the bases of the mandibles. In some species the middle tooth is notched in the centre, and its points are obtuse.

The *eyes* are smaller and much less prominent than those of the *Pranizæ*; they are composed of round facets, and placed at the base of the antennæ.

Seen from beneath, the head is entirely occupied by the *buccal apparatus*, which is completely covered by the two footjaws of the first pair; these are lamellar, triangular, slightly convex, denticulated, and ciliated on the rounded interior margin. These two plates, which present a small notch at the apex, in which is inserted a small, oval, ciliated, palpiform appendage, lie over each other in the middle, leaving a considerable free space at their base and apex; they are attached at their base by a hinge, upon which they turn so as to open downwards; they are enclosed laterally by the projecting frame of the buccal apparatus. The footjaws of the second pair consist of three or four flat joints, diminishing in size from the base to the apex; they are destitute of both palpus and flagellum, and vary according to the species. Within these parts there is an apparatus the nature of which the author has been unable to ascertain with certainty: at the highest part, in the median line, is a round orifice, which may be a sucker; below this is a sort of crescent-shaped aperture, then another round orifice accompanied by small acute jaws, and lastly a vertical aperture margined with a sort of lip. These parts are very difficult of detection.

To the base of the buccal apparatus are attached three ciliated lamellar appendages, the median one triangular and covering the two others, which are rounded in form. These three laminæ, which have some relation with the lamellar footjaws of the Epicarides, have for their function to convey to the mouth, with the water which they set in motion by their constant agitation, the small objects which serve as the nutriment of these Crustacea; these pass through the interval at the base of the first pair of footjaws.

In the *Ancei* the first two thoracic segments become intimately united with the head; the first two pairs of feet accompany them, and the cephalothoracic portion thus formed is separated by a considerable constriction from the three narrower thoracic segments which follow, each of which bears a pair of legs.

The *generative organ* is situated at the extremity of the thorax, above the abdomen: it consists of a long penis, showing throughout the course of the canal which traverses it. This penis is in the median line of the thorax; its base is formed by the first branchial feet, and it is protected above by a sort of cup formed by a fold of skin. This cup seems to be destined to receive the laminæ of the branchial false feet when they are raised over the thorax, and by this combination the generative organs are completely protected.

This structure is common to all the species, and the organ only varies in form. Thus in *Anceus Manticorus* the penis is greatly developed, and consists of a long erectile tube diminishing from the base to the apex, with a central canal traversing it from end to end. It is truncated at the apex, which is surrounded by a thickened portion notched in the middle, the extremities of which form two valves or excitative organs. In *Anceus Brivatensis* the tube is not so long, and appears to be articulated and capable of being invaginated in the lower parts; the extremity is also furnished with two lateral prehensile or excitative organs. In *Anceus Trigli* the penis is short, tubular, and inflated in the middle.

Structure of the Female Ancei.

The female *Ancei* are so different from the males that, without tracing their transformations, their connexion could not have been suspected. The head, instead of being of considerable size, as in the males, is very small, and is moreover deprived of the two large mandibles; the thorax, instead of being cylindrical and elongated, formed of distinct segments and divided into two parts by a constriction, is oval, flattened at the sides, inflated in the middle, and as it were deformed by the great quantity of ova which it contains.

The head, seen from above, is globose in the centre, flattened at the margins, broad at the base, and truncated at the apex. It has no apparent neck, but is deeply inserted between the two anterior processes of the thorax. Transverse lines in the thorax indicate its division into five segments; all round the thorax is a broad margin, which serves for the attachment of the five pairs of legs. The eyes are pretty large, and placed at the origin of the antennæ.

Seen from beneath, the head presents, first of all, two footjaws of the first pair, which originate beneath the eyes, and consist of four broad joints of equal length, but diminishing in width from base to apex. The last joint is rounded at the end, and bears some hairs. These two footjaws meet in the median line of the head, and pass its apex a little. Beneath these is the

second pair of footjaws, also composed of four joints, of which the apical one is the narrowest; these, which, like the preceding, are in a vertical position, close the buccal orifice.

The head, in the transformation of the females into *Ancei*, is the last part to undergo metamorphosis; the author has seen individuals in which the whole body had become changed, whilst the head still retained its *Praniza*-form.

The lower surface of the thorax is covered throughout with large oval laminæ, which spring from the outer margin and join in the median line; these form a large incubatory pouch, in which the ova and young are contained.

On the Habits of the Ancei.

The fecundation of the females is effected while they are still in the *Praniza*-state. Immediately afterwards they become transformed into *Ancei*, and the ova make their appearance; but, as in many other Crustacea, the young do not at once quit their mother, but remain attached beneath her thorax, probably waiting until she shall transport them into situations where they will be able to find their proper nourishment. In a few days, however, they disperse, swimming with great rapidity.

After the exclusion of the young, the female appears quite empty and reduced almost to a mere skin; but through this the digestive apparatus, still containing some food, may be detected: in this condition their movements are very slow, and they soon perish. The existence of the males, on the contrary, may be much more prolonged: the author has kept one of them alive for two years, although it was placed in unfavourable circumstances. The *Pranizæ*, also, may live for a long time: some of them were kept for two years before undergoing their transformation into *Ancei*. Their vitality appears to be extraordinary. In examining them under the microscope, M. Hesse, in order to paralyze their movements, immersed them in fresh water, and even mixed this with alcohol, and kept them in this fluid until all motion, and even circulation, was suspended; but nevertheless, by putting them again into sea-water, he found them alive and active on the following day.

The reproduction of the *Ancei* appears to take place at all seasons, young animals of various ages being always found mixed with the adults. Nevertheless the author thinks that fecundation takes place in September, October, and November.

All the individuals found upon fishes were in the *Praniza*-form, and these speedily became transformed into *Ancei*; those obtained on the shore, and mixed with *Ancei*, rarely underwent this metamorphosis. The *Pranizæ* inhabit the interior of the mouth of fishes, fixing themselves upon the palate and the

branchiæ; they also attach themselves to the body, and are frequently found upon its surface, having probably escaped from the mouth or gills when alarmed by the capture of the fish. It is chiefly in the months of July, August, September, and October that *Pranizæ* are met with upon fishes.

On the shore, the *Pranizæ* and *Ancei* are usually found under sea-weeds, especially the *Soleniæ* which grow upon the walls of harbours; they also hide themselves in the interstices of the masonry, or under stones slightly covered with mud. In the *Praniza*-state, they do not seem to fear either heat or light, or to suffer by the absence of water; in this state, also, they are extremely active, swimming and running with great rapidity. Natation is effected by means of the abdominal feet, the animal extending itself horizontally, and holding its legs extended in the attitude of walking: it swims in circles, in the manner of the *Caligi* when seeking a fish to which to attach themselves.

In the perfect state, the *Ancei* are far less active, swimming and walking very little and with difficulty, and hiding themselves from the light; their habits are evidently sedentary, and in striking contrast to their previous mode of life. They then lie constantly on the shore, in little burrows or galleries. Their bodies being thus protected, their large mandibles may serve to defend them against all aggressions from without; and that they constitute powerful cutting organs is evidenced by the fact, observed by the author, that when several male *Ancei* are kept together in a vessel, the limbs of some of them will be amputated by a clean cut. They probably serve also for the purpose of seizing prey, although the author attributes to the ciliated laminæ of the mouth a certain part in procuring nourishment consisting of Infusoria and minute Mollusca and Crustacea.

On the Food of the Ancei.

As to the nature of the food of these animals, however, M. Hesse does not appear to have arrived at any positive certainty. In the *Praniza*-state they live on the shore, under stones or seaweeds, about which the author found the débris of animal and vegetable substances, small Crustacea, Mollusca, &c. By furnishing his living specimens with similar articles, the author was unable to bring his *Pranizæ* to maturity; and all those which he obtained from the ova died in about six weeks after their exclusion. Nevertheless some of those which he collected in an early form on the shore arrived at their full size in his aquaria; and their not undergoing their final metamorphosis is probably due to their being females, which could not be transformed until after they had received the influence of the male. All those collected from fishes became converted into *Ancei* in a few days

after their capture. In a note the author says, "When the *Pranizæ* are taken too young, it would appear that the nourishment which they find in the vessels containing them is insufficient, as they always perish. Those hatched in my possession never succeeded in passing their third change of skin. But when they are at their last period, it is probable that the Infusoria and other microscopic animals which live among marine plants, and the decomposed *Soleniæ,* which are reduced almost to a fluid state, are sufficient for them. This is also the case with the *Ancei,* which content themselves with this food, without appearing to suffer from it. Nevertheless I have noticed that, when other nourishment was wanting, the male *Ancei* devoured their females, especially those which were weakened by the production of their young. . . . . . I have also ascertained that a male *Anceus Manticorus* ate a small dead Annelide which I had given to it; so that it appears certain that these Crustacea feed both upon animal and vegetable substances, but especially the former when they are able to procure them."

Hence it would appear that animal food is necessary for the transformation of the *Pranizæ,* and that it is for this reason that they attach themselves to fishes for a portion of their life. They prefer those which are very viscous, such as the flat fish, gurnards, and wrasses; and we may suppose that they absorb this mucilage: but it is easy to recognize the presence of blood in their stomachs, and sometimes they are so gorged with blood as to be as much deformed by it as if they were filled with eggs.

Upon the suctorial powers of the *Pranizæ* the author has made the following observations. On agitating the water of a vessel containing *Pranizæ,* they attached themselves firmly to a fragment of *Zostera,* but without employing their thoracic feet. On examining them with a lens, M. Hesse saw, through the tissues of the plant, that they were attached by the suctorial action of the mouth, which formed a sort of disk. The same thing occurs when they attach themselves to a fish: clinging firmly to the fish by the two thoracic feet situated at the sides of the head, and also by the hooked extremity of the rostrum, they open the door-like footjaws which close the mouth beneath, and apply the head to the part upon which they desire to adhere; then, by means of the orifices already described, they exert a powerful suction, puncture the skin with their innermost masticatory organs, and pump up the fluids necessary for their nourishment.

When transformed into *Ancei,* these Crustacea are never met with on fishes; but most of those obtained by the author from *Pranizæ* had this origin. Two species, however, are supposed

by the author to live solely on the shore; at least they underwent their metamorphosis in his aquaria without having attached themselves to fishes: these are *Anceus Brivatensis* and *A. Manticorus*. The individuals of various species kept by the author, some of which existed in captivity for more than two years, fed upon decomposed sea-weeds or upon the minute animals which might be met with amongst these and in the sea-water with which the vessels in which they were preserved were filled.

Classification of the Ancei.

The systematic position of the *Ancei*, in the author's opinion, is between the parasitic *Cymothoadæ* and the *Epicarides*, the latter being, like them, suctorial Crustacea. From the *Sphæromidæ*, with which they have been placed, they differ in the structure and arrangement of the respiratory organs, in the presence of the large mandibles in the male, in the great size of the head in the same sex, in the form and structure of the antennæ, and in the conformation of the buccal organs. The *Sphæromidæ* have seven thoracic segments and seven pairs of thoracic limbs; in the *Ancei* the number of these segments and pairs of limbs is only five: the *Ancei* have a narrow abdomen, composed of six perfectly separate segments; whilst the *Sphæromidæ* have only two or three segments in this region of the body, and even these are generally soldered together. The two groups are further distinguished by the nature of the integuments, and especially by the mode in which the eggs are carried previously to the exclusion of the young. In the *Sphæromidæ* they are contained *within the carapace*; but in the *Ancei* they are placed *outside* the body, beneath the membranous laminæ which spring from within the thoracic feet and, by lying over each other, form a large incubatory pouch. The author also calls attention to the analogy presented by the female *Ancei* with those of *Ourozeuktes*.

In the present paper M. Hesse describes eleven species of the genus *Anceus*, several of them as new; but he complains that, from the imperfect descriptions of previous authors, he has often found it impossible to identify their species. He divides them into four sections, characterized by the form of the large laminar mandibles of the males:—

1. Mandibles in the form of nippers, denticulated only at their extremities.

   A. Formica; A. Brivatensis.

2. Mandibles hatchet-shaped; their inner margins without denticulations.

   A. asciaferus.

3. Mandibles falciform, with the inner margins smooth, but presenting impressions of denticulations; outer margins with a projecting haft (*contre-fort*).
A. erythrinus; A. falcarius; A. Manticorus.

4. Mandibles falciform, with the inner margins denticulated, and with no projecting haft on the outer margins.
A. Trigli; A. Scarites; A. Lupi; A. rapax; A. verrucosus.

XLV.—*On the Fecundation and Development of* Marsilea. By Dr. Hanstein*.

When the task was set me of reporting to the Academy upon the capability of development of the so-called *Nardoo-fruits* (the capsules of an Australian species of *Marsilea*), and upon the processes observable in it, I was unable to trace either the fecundation or the development of the germ-plant upon the few fruits first sent by Alexander Rose, as nearly all the prothallia remained unfertilized. Since then I have succeeded in repeated sowings, for which fruits sent by Mr. Osborne, of Melbourne, and by Dr. Ferdinand Müller, of the Botanic Garden at that place, were employed, in witnessing the reproduction and germination of this genus, which were previously unknown.

About four hours after the micro- and megaspores have escaped into the water in the manner formerly described by me †, and issued from their sporangia, the first alterations are perceptible in them. In the small androspores the contents, of starch and proteine-substance, have then formed a more homogeneous plastic mass, and become somewhat contracted all round from the margin, leaving only a few granules on the latter. This mass is then quickly divided, by three planes of segmentation perpendicular to each other, into eight equal parts, and each of these is immediately broken up in two directions, different from each other and from the previous directions of division, into four parts, disposed in relation to each other in the manner of the angles of a tetrahedron. In this way thirty-two equal portions of protoplasm are produced by an act of division which resembles the process of segmentation in the animal ovum; and it is only after the completion of this that a cell-membrane is formed around each of them.

In each of these thirty-two cells, which retain their regular arrangement, a spermatozoid is developed. The four spermatozoids of each tetrahedral group lie in the approximated halves of

* Translated by W. S. Dallas, F.L.S., from the 'Monatsbericht der Akademie der Wissenschaften zu Berlin, August 1864, p. 576.

† Monatsber. Berl. Akad. 1863, p. 414.

the four cells. The process is completed in from eighteen to twenty-two hours. Soon afterwards the solid exosporium of the androspore breaks up, and the contents enclosed by the delicate inner membrane escape; the contents either burst the membrane during their escape, or form a transparent spherule from which the daughter cells issue by degrees and set free the spermatozoids.

These have previously been in whirling motion; they burst their mother cells singly, and hurry from them with the rapidity of an arrow. Each spermatozoid consists of a corkscrew-like filament, to the last remarkably large turns of which a large globular vesicle adheres; the latter contains numerous starch-granules in a clear fluid, and resembles an independent cell surrounded by a sufficiently firm membrane. This is by no means a part of the mother cell, which, on the contrary, remains behind empty after the escape of the spermatozoid. The screw-like filament has twelve or thirteen turns; it is very closely twisted at the apex, and is beset, especially on the lower and wider turns, with numerous very long cilia, which, when bent forwards in swimming, often project beyond the tip of the screw.

In the meantime the prothallium with the archegonium has been developed on the macrospores. Even before the escape of the macrospore, its vertex, inflated in the form of a wart, is filled with yellowish finely granular plasma, while the rest of its space contains the well-known large starch-grains, oil-drops, and proteine substances. Several hours after the escape of the spore, this lentiform mass of protoplasm is still undivided by any perceptible septum from the rest of the inner space of the spore, and is therefore not a complete cell; but in about five or six hours it is cut off by a proper cellulose membrane. Soon afterwards its plastic contents separate into a roundish central principal mass and a peripheral layer which is thicker towards the free upper surface; the latter then gradually divides into smaller and smaller portions, which surround the central mass in a single layer. The cell-body thus sketched out, but not completed, breaks up at the slightest touch; but subsequently first the central and finally the peripheral parts surround themselves with resistant cell-walls, which enter into close mutual connexion.

The central cell is then the primary cell of the nascent archegonium, the mother cell of the germ; the peripheral cells form the prothallium. In the middle of the basal surface the central cell is sometimes in immediate contact with the septum between the prothallium and the interior space of the spore, and is therefore excentric. Exactly at its vertex four regularly placed cells soon exceed the others in size, and rise into a wart, each of them

at the same time being divided again by a septum directed from without inwards towards the common point of contact of all the four. By the further elevation of the four upper daughter cells the neck of the archegonium is completed.

At about twenty to twenty-four hours after the escape of the spores, the archegonium is ready for impregnation; and fertilization takes place without being limited to any particular time of the day*. Beneath the vertex of the central cell a portion of colourless mucus separates from its yellowish mass of protoplasm, and fills a somewhat lentiform space below the neck of the archegonium, which frequently appears to be divided by sharp boundary lines from the contracted globular protoplasm†. This mucus swells, presses upwards, bursts out suddenly with a violent explosion between the four pairs of cells of the archegonium, and thus opens the canal of its neck, which then leads from without into the interior of the central cell. The mass thrown out often remains for days unchanged near the orifice.

Of the swarming spermatozoids many are usually already at hand. They do not seek after the entrance in the mucous envelope of the gynospore, but penetrate it where they come upon it. In this process the starch-saccule is an obstacle; by energetic whirlings they get rid of it, and then swim to the orifice of the archegonium, usually with the apex of the screw in front, and then, as before, very rapidly, or in the reversed position, and then more slowly.

Immediately after the expulsion of the mucus, I saw a spermatozoid hasten by, turn the apex of the screw into the orifice, turn rapidly upon its axis for a moment, as if it had to overcome some internal resistance, and then suddenly disappear in the interior of the archegonium, where it was impossible to trace it further, on account of the opacity of the prothallium. In one case two disappeared, one after the other, in the same archegonium. All subsequent ones were rejected, although no hindrance to their admission was observable.

The number of spermatozoids which collect in the mucous envelope of a gynospore often amounts to several hundreds. Whole tufts of them adhere by their points to the orifices of the fertilized archegonia, the necks of which quickly become brown. About the unfecundated specimens those little swarming corpuscles which I formerly mentioned‡ soon occur. But I have

* I have witnessed the swarming of the spermatozoids even about midnight.

† The precise observation of the processes of material change within the central cell is prevented by the imperfect transparency of the prothallium.

‡ Monatsber. Berl. Akad. 1862, p. 114.

now ascertained, by keeping male and female spores separately, that the production of these is not directly dependent upon the spores, but that they occur with both kinds, and even with residues from other parts of the fruit of *Marsilea.* They are Monad-like creatures, which sometimes, like true Monads, swim about briskly, and sometimes, resting, become increased into chain-like series, like certain species of *Vibrio.* The perfect agreement of their form and mode of occurrence in all observed cases is, however, remarkable; and the singular manner in which both these corpuscles and the spermatozoids crowd together in front of the orifices of the archegonia induces the belief that the orifice itself may be the seat of some mechanical cause of motion, although this has hitherto escaped direct observation.

After fecundation, the contents of the central cell contract into a free spheroidal mass, which, like the prothallium itself, has a circular transverse section; by the development of a cell-membrane, this becomes the primitive cell of the germ-plant.

In about twelve hours the division of this commences by the formation of a wall which is nearly perpendicular, if we regard the longitudinal axis of the macrospore to be placed in an upright position. This wall divides it into two somewhat unequal parts, the larger of which becomes developed into the stem, and may therefore be characterized as the anterior portion. Both these parts divide again immediately—the anterior, by a horizontal wall, into two equal parts, and the posterior, by a partition inclined backwards, into two unequal parts. The germ is now apparently divided almost crosswise into four cells, of which the anterior upper one becomes the first leaf, and the posterior upper one the first root. The anterior lower cell is immediately divided again into two cells by a wall starting from the horizontal wall and descending forwards; the upper of these (now the middle one of the anterior three cells) is the primitive cell of the growing bud. The separated lower cell of the anterior side is developed, in common with the lower posterior cell, into a parenchymatous mass, which, as the so-called *foot*, long retains the young germ-plant in the prothallium and on the gynospore. Each of the three other cells proceeds on its own course of development.

Three walls, produced one after the other, following the outline of the cell in their position and curvature, and directed towards each other internally, cut off from the primitive root-cell an apical root-cell in contact with the boundary of the germ posteriorly and superiorly; and in this the peripheral side speedily separates, in the form of a cap-like outer cell, from an inner one of a three-sided pyramidal shape. The former is the first cell of the pileorhiza. It first divides crosswise into four contiguous

superficial cells, and then continues dividing, sometimes by transverse and sometimes by longitudinal walls. The inner cell, which is now the true apical root-cell, proceeds to separate lateral cells of division alternately in three directions, which likewise originate the very uniform tissue of the root by longitudinal and transverse septa. At first, however, this process takes place very slowly.

The most rapid progress is made by the first leaf. Its primitive cell is first broken up, simultaneously with the two subjacent cells of the anterior half of the germ, into two equal lateral halves, in a plane standing perpendicular to the first three divisional walls. In both, the further division takes place by the production of divisional walls alternately from above and from the front, tending towards each other internally, separating discoid cells from the apical cell, which is rising forwards and upwards. In this way the leaf soon acquires a conical form, constantly becoming more acute, which finally passes, by the repeated extension and division of the cells of the second and third order, into the filamentous form, which the first leaf retains.

The evolution of the bud takes place but slowly. Its primitive cell is divided by the above-mentioned perpendicular septum into two adjacent cells, which are apparently similar, but are of very unequal value. One of them becomes the second leaf: the other continues to be the apical cell of the incipient axis of the stem; and thus the symmetry of the anterior side of the germ is for the moment destroyed.

In the apical cell, three septa approximating internally, and running nearly parallel to the three lateral walls, separate three more divisional cells—first an upper one, then a lower one, and lastly an inner lateral one adjacent to the second leaf: they leave the apical cell diminished between them, and are developed from no independent parts. The axis of the apical cell, which is now of a three-sided pyramidal form, furnished with a strongly arched basal surface directed forward, now exactly indicates the direction of the further development of the stem-bud. A seventh septum, running similarly to the fourth, but more strongly curved downwards on the side opposite to the second leaf, and cutting off a larger daughter cell, gives origin to the third leaf, which consequently makes its appearance opposite to the second, and restores the symmetry of the bud.

Next trimerous cycles of interstitial cells issue from the apical cell, corresponding to its three walls, until the fourth and fifth leaves are produced from it in the same direction and in the same manner as the second and third. No law could be discovered for the number of these interstitial cells, which rapidly

increases between the first leaves. The increasing covering of the bud with hairs, and the liability to injury of the young vegetative point, render the observation of the further development difficult. But all the facts hitherto observed go to prove that the apical cell continues its further evolution in the same fashion, even in the growing stem-bud of the old plant. The leaves always appear exactly bipartite, somewhat approximated on the upper side of the horizontal axis. It is consequently to be supposed that all of them, like the first, originate only from the cells of the two upper series which proceed from the apical cell, whilst the third series only furnishes the commencement of roots and internodial cells.

This whole process of cell-division therefore shows that the first perpendicular wall divides the germ into the primitive cells of the stem and root, and that the ideal primary axis of the free germ is consequently to be regarded as horizontal. From the stem-cell the first septum separates the first leaf, which has the import of a cotyledon. The second furnishes a piece which, as it only forms, in common with a divisional cell of the root of the same order, a parenchymatous body situated laterally to the axis, must be regarded, not as a metamorphosed leaf, but as an internodial part, like many which subsequently issue from the apical cell of the stem alternately with the foundation-cells of the leaves. Consequently the first root also, which lies exactly in the line of the posterior extension of the main axis of the stem, acquires the position and direction of a main root. On the contrary, the view that the foot is essentially the aborted primary axis, and that the first root and first bud are only adventitious organs, is supported neither by the position nor by the sequence of the septa in and between the constituent foundation-cells of the germ.

The first germ-leaf is situated in the median line of the germ, the subsequent ones to each side. Between the first and second leaves the divergence is about $= \frac{1}{4}$; the rest follow under a divergence of $\frac{1}{3}$, whilst the spiral continually becomes closer. On the other hand, the division of the apical cell itself passes rapidly into an homodromous spiral with a divergence of $\frac{1}{3}$. After the second leaf the cell-multiplication no longer commences with a perpendicular septum, but rather with walls directed towards each other laterally. Their development is similar to that known to occur in other Fern-leaves. They gradually attain to a greater extension, which only reaches its term about the tenth or twelfth leaf.

The prothallium follows the development of the germ itself by an independent growth, moulding itself upon the form of the germ. At last the rapidly growing leaf bursts it above, and the

root subsequently beneath. The root then penetrates into the soil, the prothallium having been fastened to the surface by its rootlets. The foot beneath is intimately adherent to the tissue of the prothallium, and stretches over the upper opening of the spore, for the purpose of taking up its nutritive material and handing this over to the other parts of the germ. The young bud remains long concealed; but when it subsequently breaks out, the cast remains of the prothallium perish.

The more particular description of the entire process of development, especially the cell-division of the germ, the appearance of the vascular bundles and of the later roots, and the evolution of the leaves, will shortly be published, with the necessary figures, in Pringsheim's 'Annalen.'

XLVI.—*Diagnoses of new Forms of Mollusca from the Vancouver District.* By Philip P. Carpenter, B.A., Ph.D.

The shells here described were mostly collected by Indian children for their excellent teacher Mr. J. G. Swan, in the neighbourhood of Neeah Bay, W. T. They were presented by him to the Smithsonian Institution, Washington, D.C.; and, in accordance with their liberal policy, the first available duplicates will be found in the British Museum or in Mr. Cuming's Collection. The species are numbered to correspond with the list in the British Association Report for 1863, pp. 626–628; see also pp. 636–664.

5. *Mæra salmonea.*

M. testa parva, solida, compacta, subquadrata; lævi, nitente, epidermide tenui cinerea induta; extus pallide, intus vivide salmoneo tincta; marginibus dorsalibus rectis, ad angulum 120° separatis, umbonibus haud extantibus; marginibus antico et ventrali regulariter late excurvatis; parte postica brevissima, haud angulata: intus, dent. card. utraque valva ii., quorum unus bifidus; lateralibus v. dextr. æquidistantibus, ant. extante, post. parvo; nymphis rectis, haud conspicuis; cicatr. add. post. subrotundata, ant. subrhomboidea; sinu pallii satis regulariter ovali, per iv. inter v. partes interstitii porrecto. Long. ·57, lat. ·45, alt. ·11 poll.

Variat testa aurantiaca, rarius albida, rosaceo tincta.

Hab. San Francisco (*Pac. Rail. E. E.*); Neeah Bay (*Swan*), plentiful; Monterey, 20 fathoms (*Cooper*).

In shape almost close to *Macoma crassula*, Desh. (Arctic); but that species is thinner, not glossy or salmon-coloured, and has no lateral teeth.

6. *Angulus variegatus.*

A. testa forma *A. obtuso* simili, sed costa interna omnino carente, valde inæquilaterali, solidiore, nitente, rosaceo et flavido subradia-

tim eleganter variegata; striis incrementi concentricis, postice extantioribus; umbonibus postice flectentibus, obtusis; parte antica prolongata, regulariter excurvata; marginibus dorsali et ventrali subparallelis, subrectis; parte postica curtiore, subangulata: intus, dent. card. utraque valva ii. minutis, quorum alter bifidus; v. dext. dent. lat., ant. curto, satis extante, post. nullo; nymphis curtis, latis, parum concavis, subito sectis, valvis postea subalatis; sinu pallii fere cicatr. ant. tenus porrecto. Long. ·72, lat. ·42, alt. ·15.

Hab. Neeah Bay (*Swan*); Monterey and Catalina Island, 20–60 fathoms, rare (*Cooper*).

Subgenus Miodon*.

Testa Lucinoidea, dentibus cardinalibus, ut in *Cardita*, elongatis; laterali antico parvo instructa.

This little group of species is intermediate in character between *Astarte*, *Venericardia*, and *Lucina*. It first appears in the Great Oolite, where it is represented by *Astarte* (*Miodon*) *orbicularis*, J. Sby. Min. Conch. pl. 444. f. 2, 3. This must not be confounded with a second and true *Astarte orbicularis*, by the same author, pl. 520. f. 2. It appears in Mr. Searles Wood's Crag-series as *Astarte corbis*. The following is the only recent species at present known.

9. *Miodon prolongatus*.

M. testa parva, solida, tumida, compacta, albida; ventraliter antice valde prolongata, excurvata; lunula longa, rectiore, haud impressa; umbonibus antice inflectis, obtusis, valde prominentibus; margine dorsali postico parum excurvato; costis radiantibus x.–xii. latis, obtusis, marginem attingentibus, parum expressis, dorsaliter obsoletis, a liris incrementi concentricis, plus minusve distantibus, expressis, hic et illic interruptis: intus, margine a costis plus minusve obsoletim crenulato; cardine dentibus v. dextr., uno postico, inter duas fossas elongato, et lat. ant. lunulari; v. sinistr., dent. ant. triangulari, post. valde elongato, lat. ant. minimo, obsoleto; cicatr. add. subrotundatis, ventraliter sitis. Long. ·23, lat. ·24, alt. ·16.

Subgenus Adula, Add. (diagn. auct.).

Testa inter *Modiolam* et *Lithophagum* intermedia, cylindracea; umbonibus obtusis; parte antica longiore; ligamento subinterno, valde elongato; epidermide haud testacea.

Animal byssiferum, in cryptis affixum; musculis adductoribus majoribus, antico ovato.

Constituted by Messrs. Adams for *A. soleniformis*, D'Orb., which very closely resembles the young of the Vancouver species: enlarged to receive the shells of Lithophagoid shape which are

* Th. μείων, smaller; ὀδοὺς, tooth.

moored by byssus, like *Modiola.* The largest known species is *A. falcata,* Gld., which is normally straight, but often grows in a twisted burrow. *A. parasitica,* Desh., and the long-known *A. cinnamomea* appear congeneric.

13. *Adula stylina.*

A. testa cylindracea, lithophagoidea, lævi, tenuissima, parum arcuata, subnacrea, albida, postice interdum livido tincta; epidermide nitente, lævi, solidiore, nigro-fusca: testa jun. typice modiolæformi, umbonibus subanticis, obtusissimis; margine dorsali antice (rarissime paululum, testa minima, postice) tenuiter crenulato: testa adulta marginibus dors. et ventr. fere parallelis, ant. et post. rotundatis; umbonibus detritis, haud conspicuis, circiter sextantim antice sitis; incrustatione haud solida, densissime spongiosa, aream posticam diagonalem tegente, supra valvas prolongata, appressa; ligamento interno, postice valde prolongato; pagina interna pallida; cicatr. add. postica tumida, pyriformi, antica (quoad familiam) maxima, haud impressa, oblonga; cicatr. pedali antica magna, circulari, impressa; callositate subumbonali (testa jun.) cicatr. pedalem versus conspicua. Long. ·155, lat. ·4, alt. ·5.

Variat t. magis arcuata; ut in *A. falcata,* antice tumidiore, subangulata.

Variat quoque testa attenuata.

Variat interdum ventraliter late hiante.

Hab. Neeah Bay, abundant (*Swan*); Monterey (*Taylor*).

On smashing a large lump of hard clay, bored by Pholads, Petricolids, &c., large numbers of this species, with a few of *A. falcata,* of all ages from ·06 onwards, were found *in situ.* Several struggled for room in a single crypt. The umbos are abraded by the wide opening of the valves.

14. *Axinæa* (?*septentrionalis,* var.) *subobsoleta.*

A. testa ?*A. septentrionali* simili, parum inæquilaterali, haud tumida; umbonibus obtusis, latis, satis prominentibus; cinerea, rufo-castaneo varie picta; epidermide copiosa, sublaminata; marginibus ventrali et postico valde rotundatis, antico parum producto, dorsali recto; sulcis radiantibus subobsoletis sculpta, dorsaliter sæpe evanidis: intus, marginibus ventrali valde, ant. et post. parum crenatis; lamina cardinis subangulata; dentibus paucioribus, validis, angustatis; cicatr. add. antica castanea, callosa; ligamento sulcato. Long. ·13, lat. ·12, alt. ·7.

Hab. Neeah Bay (*Swan*); Shoalwater Bay (*Cooper*).

Middendorff's shell is figured with much stronger ribs, but may have been described from decorticated specimens.

15. *Siphonaria Thersites.*

S. testa parva, tenui, haud elevata, valde inæquilaterali, dense nigro-castanea, lævi, seu interdum costulis paucis, obtusis, obsoletis,

radiatim vix ornata; epidermide lævi, tenui, fugaci; costa pulmonali intus et extus valde conspicua, tumente; vertice obtuso, plerumque ad quadrantem, interdum ad trientem totius longitudinis sito; intus intense nigro-fusco, margine acuto. Long. ·46, lat. ·33, alt. ·17.

Hab. Neeah Bay (*Swan*).

This genus, which culminates in western tropical America and at Cape Horn, is not known in California. The Vancouver species resembles *S. lateralis* and its congeners, but differs in having an enormous lung-rib and no colour-rays.

16. *Mopalia* (*Kennerleyi*, var.) *Swannii.*

M. testa *M. Kennerleyi* typicæ simili, sed jugo fornicato, haud carinato; omnino rubida, sculptura multo minus expressa; areis lateralibus vix definitis; latera versus subgranulata; dorsum versus lineis jugum versus procedentibus, interstitiis punctatis; sinu postico latiore; limbo pallii lato, coriaceo, vix piluloso. Long. 2·4, lat. 1·, div. 120°.

Hab. Tatooche Island (*Swan*).

23. *Margarita Cidaris*, A. Ad.

M. testa magna, conica, Turcicoidea, tenui; albido-cinerea, nacreo-argentato; anfr. nucleosis?...(decollatis), norm. vii., subplanatis; suturis alte insculptis; superficie spiræ tota valide tuberculosa, seriebus tribus, alteris postea intercalantibus; peripheria et basi rotundatis, carinatis; carinis circ. viii., haud acutis, irregularibus, scabris, haud tuberculosis; lacuna umbilicali vix conspicua; apertura subrotundata; labro tenuissimo; labio obsoleto; columella arcuata. Long. 1·1, long. spir. ·65, lat. ·75, div. 60°.

Hab. Neeah Bay (*Swan*).

Mr. A. Adams suggested the above expressive name for this very remarkable and unique shell.

25. *Gibbula parcipicta.*

G. testa solidiore, parva, conica, pallida, purpureo-fusco varie nebulosa et maculata; anfr. v., rotundatis; carinis ii. validis in spira se monstrantibus, minore intercalante; interstitiis subsuturalibus, sublævibus, inter carinas obtuse decussatis; lira peripherica definita, sæpe in spira se monstrante; basi valde rotundata; lirulis basalibus circ. v. rotundatis, subdistantibus; apertura subcirculari; columella arcuata; umbilico majore, infundibuliformi, haud angulato. Long. ·14, long. spir. ·07, lat. ·13, div. 70°.

Hab. Neeah Bay (*Swan*); Santa Crux (*Rowell*).

26. *Gibbula succincta.*

G. testa parva, subelevata, solidiore; livida, testa jun. strigis angustis, creberrimis, fusco-purpureis penicillata, testa adulta maculis quoque magnis nebulosa; anfr. v., subquadratis; liris obtusis medianis

et striis subobsoletis cincta, suturis valde impressis; basi rotundata, obtuse angulata, striis sæpe evanidis spiralibus ornata, testa adulta circa umbilicum magnum, infundibuliformem, vix angulatum, sæpe tumidiore, medio obtuse impressa; apertura subquadrata, parum declivi; columella subarcuata. Long. ·16, long. spir. ·07, lat. ·16, div. 70°.

Hab. Neeah Bay (*Swan*); Lower California, on *Haliotis* (*Rowell*).

27. *Gibbula lacunata.*

G. testa parva, fusco-purpurea, solidiore; marginibus spiræ valde excurvatis; anfractibus nucleosis normalibus, postea iv. subplanatis, suturis distinctis, apice mamillato; sublævi, circa basin vix angulatam striolata, striolis spiralibus distantibus; apertura suborbiculari, parum declivi; labio juxta umbilicum constrictum, quasi lacunatum, lobato; columella callositate parva umbilicum constringente. Long. ·11, long. spir. ·05, lat. ·11, div. 80°.

Hab. Neeah Bay (*Swan*).

28. *Gibbula funiculata.*

G. testa parva, elevata, compacta, fusca; marginibus spiræ excurvatis; anfr. vi., haud tumidis, suturis parum impressis; lirulis crebris rotundatis undique cincta, quarum v. in spira monstrantur; interstitiis parvis; basi rotundata, haud angulata; umbilico parvo, haud carinato; apertura suborbiculari, parum declivi; columella vix arcuata. Long. ·24, long. spir. ·11, lat. ·2, div. 70°.

Hab. Neeah Bay (*Swan*), specimen unicum.

29. *Hipponyx cranioides.*

H. testa valde planata, majore, albida; vertice nucleoso? ...; testa adulta apice interdum subcentrali, sæpius plus minusve postico; laminis incrementi confertis, undique rapide augentibus; striis radiantibus fortioribus, confertissimis, laminarum margines sæpe crenulantibus; margine acuto; cicatr. musc. angusta, margini contigua, regione capitis minore, sæpe dextrorsum torsa; epidermide?... Long. ·85, lat. ·75, alt. ·3.

Hab. Neeah Bay (*Swan*).

30. *Bivonia compacta.*

B. testa satis magna, sæpe solitaria, purpureo-fusca, spiraliter plerumque satis regulariter contorta, obsoletim cancellata seu sculptura fere evanida; testis tenacissime adhærente. Long. (plerumque) ·7, lat. ·3, diam. apert. ·1.

Hab. Barclay Sound; abundant on *Pachypoma gibberosum* (*Swan*).

Belongs to *Bivonia*, Gray (not Mörch). Has the aspect of *Petaloconchus macrophragma* on a large scale, but is entirely destitute of internal laminæ. One specimen had a faint colu-

mellar thread for two whirls only. Operculum normal, with thin edge, dark red.

32. *Lacuna porrecta.*

L. testa *L. puteolo* simili, sed multo majore, spira magis exserta; seu omnino fusca, seu zona pallidiore, seu pallida lineolis fuscescentibus tenuissime spiraliter ornata; epidermide tenuiter striata olivacea seu viridescente induta; tenuiore, spiraliter tenuiter striata; anfr. v., vix planatis, rapide augentibus, suturis impressis, vertice mamillato; apertura tumente; labio tenui, vix parietem attingente, intus subrecto; lacuna maxima, elongata, ad basin arcuata; peripheria expansa. Long. ·52, long. spir. ·2, lat. ·4, div. 80°.

?Var. *effusa*: testa *L. porrectæ* simili, sed multo majore; spira elevata, satis effusa; anfr. tumidioribus, suturis valde impressis; aperturam versus magis expansa. Long. ·65, long. spir. ·25, lat. ·5, div. 60°.

?Var. *exæquata*: testa *L. effusæ* simili, sed anfr. planatis, suturis parum impressis. Long. ·5, long. spir. ·2, lat. ·42, div. 80°.

Hab. Neeah Bay (*Swan*).

The form *L. exæquata* is intermediate between the very different *L. porrecta* and *L. effusa.* The *Lacunæ* vary so much (*vide* Forbes & Hanley *in loco*) that, even with a large multitude of specimens, it is not easy to state what constitutes a species.

33. *Lacuna* (? *solidula,* var.) *compacta.*

L. testa *L. solidulæ,* var., simili; parva, solida, compacta, angusta, subturrita, marginibus spiræ excurvatis: aurantiaca, interdum pallidiore zonata; anfr. subplanatis, suturis distinctis; tota superficie confertissime spiraliter striolata; basi valde angulata, subplanata; apertura subquadrata; columella vix lacunata. Long. ·23, long. spir. ·1, lat. ·17, div. 60°.

Variat testa elongata: variat quoque columella normaliter lacunata.

Hab. Neeah Bay (*Swan*).

Possibly an extreme form of the very variable *L. solidula,* Lov. (= *L. carinata,* Gld., non A. Ad., = *Modelia striata,* Gabb), yet distinct in all ages. The young shells resemble small *Litorinæ.*

34. *Lacuna variegata.*

L. testa tenui, plus minusve elevata, soluta, irregulari; adolescente fusco-purpureo; adulta livida, radiatim seu diagonaliter varie irregulariter strigata, strigis fusco-aurantiacis, sæpe ziczacformibus; anfr. vi., quorum primi compacti, apice submamillato; dein solutis, postice planatis, antice expansis; basi rotundata seu angulata; apertura subovata; labro postice porrecto; labio sæpe parietem vix attingente; columella intus recta, extus valde lacunata. Long. ·3, long. spir. ·16, lat. ·17, div. 50°.

Hab. Neeah Bay (*Swan*).

Painted like *L. decorata,* A. Ad., which differs in having a normal growth, with very slight chink.

35. *Isapis fenestrata.*

I. testa *I. ovoideæ* forma et indole simili; carinis ix. acutis (quarum iv. in spira monstrantur) cincta; interstitiis duplo latioribus, concinne quadratim decussatis, lirulis radiantibus acutissimis; anfr. postice tumentibus, suturis valde excavatis; peritremate continuo; labro a carinis pectinato; labio parietem parum attingente, medio calloso; umbilico angusto. Long. ·18, long. spir. ·13, lat. ·19, div. 70°.

Hab. Neeah Bay (*Swan*); S. Diego and Sta. Barbara Island (*Cooper*).

Dr. Cooper's shells are much smaller than those from the Vancouver district, which are white and eroded, varying much in the size of the umbilicus.

36. *Alvania reticulata.*

A. testa parva, subturrita, rufo-fusca, marginibus spiræ rectis; anfr. nucleosis ii. et dimidio, naticoideis, lævibus, tumentibus, apice mamillato; norm. iii., tumidis, suturis impressis; liris angustis, distantibus, spiralibus circ. xii. (quarum iv.–vi. in spira monstrantur), et lirulis radiantibus, supra transeuntibus, haud nodulosis, secundum interstitia incurvatis, eleganter exsculpta; interstitiis altis, quadratis; peritremate continuo, subrotundato, acutiore. Long. ·085, long. spir. ·05, lat. ·04, div. 30°.

Hab. Neeah Bay; two specimens in shell-washings (*Swan*).

37. *Alvania filosa.*

A. testa *A. reticulatæ* indole et colore, haud sculptura, simili; multo majore, elongata; anfr. nucl. ?... (detritis), norm. iv.; striis parum separatis circ. xviii. (quarum circ. xii. in spira monstrantur) cincta; rugulis radiantibus posticis creberrimis, haud expressis, circa peripheriam evanidis; peritremate continuo; columella rufo-purpureo tincta. Long. ·13, long. spir. ·09, lat. ·06, div. 20°.

Hab. Neeah Bay; one specimen in shell-washings (*Swan*).

[To be continued.]

XLVII.—*Description of a new Species of* Eublepharis. By Dr. Albert Günther.

Eublepharis fasciolatus.

Very similar in general habit to *E. Hardwickii*, but with the tubercles much less numerous and separated by granular interspaces as wide as the tubercles themselves. Opening of the ear wide. Nine upper and ten lower labials; two chin-shields larger than the first lower labial. The scales of the middle of the belly form twenty-four longitudinal series. A series of fourteen pores across the præanal region.

The *young* with brown cross bands: the first is horseshoe-shaped, and encircles the occiput, each branch advancing to the eye; there are two irregular brown spots within its concavity: the second band occupies the posterior two-thirds of the neck: the third and fourth across the middle of the trunk: the fifth across the sacral region. Tail with five brown rings. These bands and rings are broader than the interspaces of the ground-colour, which is brownish yellow.

In the *adult* only the brown edges of these bands remain; so that there is one pair of brown cross bars on the neck, and three pairs on the trunk, the space between the bars being of the ground-colour. The horseshoe-shaped band on the occiput remains single; but the markings on the head are more defined than in the young one, viz. a pair of brown rings on the crown of the head, one cross band between the eyes, and two on the snout; a longitudinal streak runs from the eye to the nostril. Lower parts white; a group of indistinct brown dots on the elbows and knees.

I am indebted to R. T. Riddell, Esq., for two specimens of this species: one is adult, $5\frac{1}{2}$ inches long, the length of the tail being $2\frac{1}{2}$ inches; the other, young example is 3 inches long, tail $1\frac{1}{4}$ inch. They were collected at Hydrabad, Sindh, where the species is unjustly reputed to be venomous.

XLVIII.—*On some peculiar Structures in the Seminal Fluid of* Ianthina. By Fritz Müller of Desterro*.

It is but rarely that pelagic animals find their way into the arm of the sea which separates the island of Santa Catharina from the mainland of South America. Amongst these visitors, which are sometimes absent for several years together, are two species of *Ianthina*, which usually make their appearance as attendants on swarms of *Velellæ*. One of them with a more acute spire (*I. exigua*, Lam.), of which only a few females have once been seen, bears its eggs upon the frothy appendage of the foot: the other, which has been repeatedly found, has a flatter spire (*I. pallida*, Harv.), and is viviparous; in this I ascertained that the frothy appendage occurs in precisely the same manner in both sexes.

In the seminal fluid of the latter species there are some very peculiar structures, to which I would call the attention of visitors to the Mediterranean and others who may have the opportunity of examining this remarkable Mollusk. It is very probable that such an opportunity may not occur to me again for years; and

* Translated by W. S. Dallas, F.L.S., from Wiegmann's 'Archiv,' 1863, p. 179.

this may be my excuse for communicating my observations upon these structures in their present imperfect state.

Even with the naked eye we may observe in the seminal fluid of *Ianthina* numerous white vermiform structures, which swim about briskly in it*. Their length is about 0·5 millim. (exclusive of the swimming-apparatus to be hereafter described). The lens enables us to distinguish, in the first place, two sharply separated divisions, which may be indicated, for the sake of brevity, as the head and tail. The head occupies about one-fourth of the total length; it is sometimes of a pretty regular conical form, sometimes furnished at its posterior thicker portion with irregular processes, and sometimes projects anteriorly in a double instead of a single point. It contains numerous granules of various sizes, with dark outlines, which render it rather opaque; no distinct membrane could be perceived surrounding it. The tail, about three times as long as the head, is anteriorly much narrower than the hinder margin of the head, but becomes gradually enlarged posteriorly, and terminates in a rounded end; it is almost completely opaque, and is densely clothed with delicate hairs about 0·03 millim. in length. These hairs are seen to move quickly, but do not strike regularly in the same direction in the manner of cilia; on the contrary, they wave and mingle together irregularly, so that we cannot regard them as the cause of the rapid movements by which the structures pass through the water in large curves. In this movement the head and tail appear to be dragged along like a heavy mass by some force lying beyond them; and this is, in fact, the case. At a distance of nearly twice the length of the head from its apex it is preceded by a conical point, with delicate but clearly marked outlines, from which a perfectly transparent membrane waves down to about the middle of the head, like a fluttering veil. Sometimes I could detect an extremely delicate longitudinal striation in this membrane. Posteriorly its outlines were evanescent, so that I could scarcely ever trace it to its hinder margin: on one occasion only, in a young individual, I distinctly saw the hinder margin, at which the membrane appeared to separate into delicate fibres. Sometimes also a slender and not sharply defined cord could be traced from the anterior extremity of the head nearly to the conical point. Whether this undulating membrane forms a conical envelope connected with the head by a central free peduncle, or whether it spreads out flat and is immediately attached to the head, I cannot decide; for, just as I was turning my attention to this question, the black clouds of a rising storm robbed me of the light so indispensable

* Probably not throughout the year: my observations were made in October, which would correspond with April in the Mediterranean.

for carrying on such an investigation as this; and when I was able to resume it, I found that my whole stock of material had become useless in consequence of the commencement of decomposition.

In the vicinity of the conical point several little lobes, resembling narrow cilia, separate from the membrane. While the structure is swimming, these little lobes oscillate rapidly and strongly, and the whole membrane is in lively undulating movement. When towed along by this singular swimming-apparatus, the tail always appeared to me to be perfectly quiet; the whole structure, from the conical apex of the undulating membrane to the rounded extremity of the tail, then forms a slightly curved bow, and the course through which it passes follows a similar curve. When the membrane, and with it the head, are quiescent, the tail is seen slowly bending and twisting about, although without producing any perceptible change of place.

Deceived by such manifold movements, I was led, in 1860, to regard these structures as parasitic animals, in which, however, I vainly endeavoured to discover traces of a mouth, intestine, &c. But when I was recently (1862) again able to examine a male *Ianthina*, I found my supposed parasites so densely packed in its semen, that I began to doubt whether I had not before me an essential constituent of the semen. And then I was at once struck with the similarity between the agitated hairs of the tail and seminal filaments which have nearly attained maturity, but have not yet separated from the place of their formation; and I soon succeeded in breaking up several tails into groups of unmistakeable seminal filaments, perfectly resembling those which were swimming about freely in the seminal fluid.

That these structures are an essential constituent of the semen was consequently established. But are they the formative organs of the seminal filaments, from which these subsequently, when mature, separate? or are they "spermatophora," around which the mature seminal filaments have collected? The former notion appears to me the more probable one; it is supported especially by specimens frequently observed, in which the seminal filaments were not only motionless, but also appeared to be shorter than in the others. Besides these, numerous other still younger forms were seen: the youngest that came under observation was of the form of an elongated egg, about 0·2 millim. in length and 0·1 millim. in breadth. The greater part of this oval body appeared perfectly transparent and empty; the thickened end alone was occupied by a roundish mass, which was rendered opaque by densely imbedded granules. It appeared darker on the side turned towards the apex of the egg, and lighter on the opposite side, although no distinct line of demarcation could be detected

between the dark and light portions. Such a line of demarcation makes its appearance when the body has grown to about 0·3 millim. in length; the paler and darker portions then appear very like a small acorn in its cup. Subsequently the pale portion becomes elongated, and grows into the caudal part of our structure; whilst the darker head portion gradually acquires a conical form, and the foremost membranous part commences its motory activity; but the tail, contrary to what occurs at a later period, is still distinguished from the head by its much lighter appearance, and, instead of seminal filaments, its surface is covered with small, roundish, transparent granules (vesicles?), thus reminding one of the globular or elongated bodies on which the seminal filaments are developed, for example, in the body-cavity of the Annelida.

XLIX.—*Descriptions of new Genera and Species of* Phytophaga. By J. S. Baly.

Fam. Sagridæ.

Sagra mutabilis.

S. supra subopaca, subtus nitida; antennis extrorsum nigro-purpureis; thorace subquadrato, antice vix producto, angulis anticis modice prominulis; elytris basi thorace multo latioribus, humeris subprominulis, a basi ad apicem angustatis, supra convexis, intra humeros sat profunde impressis, subtiliter coriaceis, infra basin minus profunde transversim impressis, tenuissime gemellato-punctato-striatis, striis fere omnino deletis.

A. Corpus rufo-igneum. C. Corpus viridi-cæruleum.
B. Corpus viridi-aureum. D. Corpus purpureum.

Mas. Femoribus posticis sat elongato-incrassatis, elytra sat superantibus, subtus bidentatis, dente antico majore; tibiis ejusdem paris apice mucronatis bidentatisque, dente exteriore valido, abdominis segmento primo deplanato, crebre punctato, tomentoso.

Fœm. Elytris oblongis, postice minus angustatis; femoribus posticis elytra vix superantibus, subtus ante apicem crista brevi instructis; tibiis ejusdem paris apice breviter mucronatis.

Long. 8–11 lin.

Hab. Cambodia, Siam.

This lovely species is most closely allied to *S. speciosa*, Lac.: it agrees so completely in nearly all its characters with that insect that a detailed description would be almost useless. I shall therefore confine myself to the points of difference between the two insects.

In *S. mutabilis* ♂ the antennæ are equally long, but stouter; the thorax is usually (but not always) slightly broader; the elytra are much broader at their base, the humeral callus being

more prominent, and causing the base of the elytra to appear more abruptly truncate; they are shorter in proportion to their basal breadth, and at the same time more quickly narrowed from base to apex, thus being less parallel and more regularly wedge-shaped; they are less deeply depressed transversely below the basilar space, their surface is more finely punctured and opake; the hinder thighs are shorter, thicker, and less attenuated towards their apex; viewed laterally, they are suddenly thickened at their base, and then gradually increase in width to beyond their middle. In *S. speciosa* they increase more gradually at first, but remain for some distance in the middle at nearly the same width; viewed from above, the outer edge in *S. mutabilis* is more regularly curved, the thickest portion of the femur being about or just beyond the middle; in *S. speciosa*, on the other hand, the thigh is more attenuated from its middle to its apex, the thickest part being rather before than at the middle itself. In the female the elytra are oblong-ovate, and not narrowed from base to apex as in the male; but I do not know any characters by which the ♀ can be separated with certainty from the same sex of *S. speciosa*, *S. Druryi*, and other allied species.

Sagra Livingstonii.

S. elongata, obscure cæruleo-nigra, supra subopaca, subtus nitida; thorace latitudine vix longiore, angulis anticis paullo prominulis, disco lævi, basi unifoveolato; elytris intra humeros leviter impressis, tenuiter sulcato-striatis, sulcis distincte punctatis, ante apicem deletis, sulcis 5^{to} 6^{to}, 7^{mo} 8^{vo}, et 9^{no} 10^{mo} pone medium nonnihil per paria approximatis; tibiis intermediis subtus ultra medium dente obtuso armatis. ♀

Long. 8 lin.

Hab. Zambesi River.

This species is nearly allied to *S. Urania* and *S. seraphica*; the very obtuse tooth or spine on the under surface of its intermediate tibiæ will without trouble serve to distinguish it from both those insects: by means of the above-mentioned characters it enters into that section of the genus which contains *S. tristis* and *S. Murrayi*; but the punctation of the elytra and the non-prolongation backwards of the prosternum show without doubt that it belongs to quite another section.

Head finely punctured; antennæ rather longer than half the body, robust, slightly increasing in thickness towards their apex, third and fourth joints ovate, nearly equal. Elytra subparallel, slightly narrowed towards the apex, the latter narrowly obtuse; above moderately convex, very slightly flattened along the suture, not depressed below the basilar space; each elytron with ten sulcate striæ, the first short; these striæ, which are nearly equi-

distant at their base, somewhat approximate in pairs on the hinder and outer portions of the disk, and are each impressed by a single row of distinct punctures; deeply impressed in front, they become shallower and their puncturing less distinct below the middle, and towards the apex of the elytron are quite obsolete; the 9th and 10th rows are placed at a greater distance from the adjoining striæ than any of the other pairs; within the outer border is a deep impunctate sulcation, which extends the whole length of the margin. Hinder thighs not extending beyond the elytra, their under surface furnished near the apex with a short ridge, either extremity of which is armed with a short tooth; hinder tibiæ with the basal half curved, the apical half nearly straight, the apex not mucronate; on their inner surface at the base is an obtuse tubercle.

Fam. Megalopidæ.

Temnaspis Mouhoti.

T. elongata, parallela, fulva, nitida, pube suberecta vestita; antennis, mandibularum apice, plaga transversa inter oculos, plaga verticali, thoracis maculis duabus disco transversim positis, elytrorum maculis sex, tibiarum apice tarsisque nigris.

Var. A. Elytrorum maculis nigris obsoletis.

Long. 4 lin.

Hab. Cambodia. Collected by the late M. Mouhot.

Head punctured, a flattened triangular space on the forehead, impressed on the centre of its basal margin with a deep fovea; epistome smooth, impunctate, impressed with a deep longitudinal groove; antennæ as long as the head and thorax, black; the black patch on the face is transverse, and often extends quite across between the eyes; the latter prominent, their inner margins narrowly and obliquely notched. Thorax rather broader than long, sides obtusely angled at their middle, deeply constricted just behind their apex; above subcylindrical, transversely grooved near the base and again in front, the anterior sulcation running into the lateral constriction; surface shining, subremotely punctured. Scutellum triangular, its apex notched. Elytra parallel, dehiscent at their apex, subelongate, upper surface rather more closely punctured than the thorax, longitudinally depressed along the suture, impressed at the base within the shoulders; basilar space obsoletely raised; on each elytron are three large black spots—one, oblong, at the base, extending over the humeral callus, a second, transverse, placed just before the middle, arising just within the lateral border and extending across nearly to the suture, and a third, subapical, triangular, its anterior border notched. Hinder thighs in the ♂ strongly incrassate, armed beneath near the apex with a stout tooth; in

the ♀ moderately thickened, unarmed. The whole surface of the body covered with coarse, suberect, fulvous hairs, mingled here and there with black.

Pœcilomorpha Thoreyi.

P. elongata, postice attenuata, pallide rufo-fusca, pilis depressis dense vestita; antennis, thorace (hoc limbo prætermisso) femoribusque anticis dorso piceis: elytris sordide flavis, postice et ad latera fuscis, marginibus lateralibus piceis; linea suturali vix ante medium fere ad apicem extensa, medio dilatata, flavo-albo pilosa.

Long. $5\frac{1}{2}$ lin.

Hab. Old Calabar.

Head broad, closely punctured; eyes large, prominent; epistome rather broader than long, separated from the face by a deep transverse groove, its surface smooth and shining, impressed on either side below the upper angles with coarse punctures; it is also clothed on either side on the same spot with a patch of adpressed hairs; face plane, closely covered with distinct punctures; on its lower edge, at the middle, is a short raised smooth line. Antennæ not equal in length to the head and thorax, piceous, their basal joints obscure rufo-fulvous. Thorax subglobose, its apex truncate, constricted at the base, sides rounded, scarcely narrowed in front, surface closely punctured, covered with adpressed hairs, a narrow line down the middle of the disk nitidous, impunctate; piceous, the entire limb rufo-fuscous; at the middle of the base is a short longitudinal line formed of adpressed whitish hairs. Scutellum broadly truncate, clothed with coarse adpressed whitish pubescence. Elytra as broad at the base as the thorax, thence quickly narrowed towards the apex, the latter dehiscent; above coarsely punctured, humeral callus prominent; surface longitudinally excavated along the suture, the excavated portion commencing immediately below the basilar space; the latter plane, not perceptibly raised above the surface of the elytron; the yellow colour on the basal half of the surface soon becomes obscured, and imperceptibly loses itself in the general fuscous colour of the sides and hinder disk. Body beneath clothed with coarse, adpressed, dirty white hairs; sides of the metasternum nearly glabrous, sparingly covered with very fine, adpressed, fulvous hairs; apical border of metasternum, together with the mesosternum, each clothed with a transverse band of coarse yellowish pubescence. Hinder thighs moderately thickened. Apical segment of the abdomen impressed with a deep fovea.

Very close, both in form and colour, to *P. tomentosa*; the two species, however, present distinct points of difference. *P. Thoreyi* is larger, its head broader, the eyes larger and more prominent; the thorax is more constricted behind, and the scutellum broadly truncate at the apex; the elytra are broader at the base,

more quickly narrowed towards their apex; the shoulders are more produced. In *P. tomentosa* the scutellum is obtuse; the longitudinal depression on the back of the elytra commences just beneath the scutellum, and not below the basilar space, as in *P. Thoreyi*. In addition to the above, there are numerous other small differences.

Fam. **Gallerucidæ.** Subfam. **Halticinæ.**

Systena Batesii.

S. elongata, pallide prasina, nitida; oculis nigris; antennis pallide rufo-fuscis; thorace basi transversim sulcato: elytris tenuiter punctatis; linea suturali vittaque submarginali ante apicem abbreviatis, obscure viridibus.

Long. 3 lin.

Hab. Ega, Upper Amazons. Collected by Mr. H. W. Bates.

Head smooth, obsoletely punctate. Thorax slightly transverse, impressed in front of the base by a shallow transverse groove; disk obsoletely punctured; sides narrowly margined, straight and parallel from their base to beyond the middle, thence slightly converging to the apex. Elytra broader than the thorax, parallel, moderately convex, slightly depressed below the basilar space, more distinctly punctured than the thorax, the punctures indistinctly arranged in numerous longitudinal striæ.

Genus Nisotra.

Corpus oblongo-ovatum aut ovatum, convexum. *Caput* paullo exsertum; *facie* non carinata, supra insertionem antennarum transversim impressa; *epistomate* paullo incrassato; *antennis* subfiliformibus, 11-articulatis; *oculis* prominulis. *Thorax* transversus, marginibus basali et apicali utrinque longitudinaliter impressis. *Elytra* thorace paullo latiora, breviter ovata; *limbo inflexo* obliquo; distincte punctata, punctis in strias bifarias confuse dispositis. *Pedes*: *femoribus* posticis valde incrassatis, subtus canaliculatis; *tibiis* posticis dorso non canaliculatis, apice spina valida acuta armatis; *tarsis* ad apicem tibiarum insertis; *unguiculis* appendiculatis. *Prosternum* subelongatum.

Type, *Nisotra gemella*, Erichs. Manilla.

In addition to the short basal thoracic impressions (common to *Podagrica* and other genera of *Halticinæ*), *Nisotra* has two others on its apical border, placed exactly opposite those at the base, and armed on their outer edges with a minute tooth, from each impression a longitudinal groove extending backwards for a greater or less distance across the disk of the thorax. The genus may also be separated from *Podagrica* by the peculiar striation of the elytra; in coloration (more or less red, with metallic-blue elytra) the majority of the species resemble many of the species of *Podagrica*.

In its geographical distribution *Nisotra* appears to be principally Eastern, the species of the genus spreading themselves

from India to Southern Australia, Mr. Wallace having sent home many novelties from the Malay archipelago: but I also possess several species from the southern portion of the African continent—thus adding another link to the evidence in favour of the former existence of land in the Indian Ocean.

Genus Sebæthe.

Corpus ovale, modice convexum, lateribus anguste marginatis. *Caput* ad oculos thoraci insertum, perpendiculare; *antennis* filiformibus, 11-articulatis; *oculis* ovatis, vix prominulis; *facie* inter antennas alte carinata. *Thorax* transversus, dorso non impressus, lateribus reflexo-marginatis. *Elytra* subdepressa, confuse punctata, anguste reflexo-marginata; *limbo inflexo* concavo, fere horizontali, margine exteriore deorsum paullo producto. *Pedes* modice robusti; *femoribus* posticis valde incrassatis, subtus canaliculatis; *tibiis* posticis dorso late canaliculatis, apice modice bisinuatis, spina valida acuta armatis; *tarsis* posticis apici tibiæ insertis, tibiæ dimidio paullo longioribus; *unguiculis* appendiculatis. *Prosternum* oblongo-elongatum, latæribus sinuatis.

Type, *Sebæthe badia,* Erichs. Manilla.

The ovate, less convex, and somewhat flattened upper body, the narrowly reflexed lateral border of the thorax, the narrow also reflexed outer margin of the elytra, together with the form of the apex of the hinder tibiæ, will serve to distinguish this genus from its allies.

Genus Arsipoda, Erichs.

Corpus ovatum aut elongato-ovatum, convexum. *Caput* modice exsertum; *facie* declivi, inter oculos transversim canaliculata; *carina* lata, vix aut modice elevata; *antennis* 11-articulatis, filiformibus aut subfiliformibus. *Thorax* transversus, basi utrinque longitudinaliter impressus, plerumque inter impressiones transversim sulcatus, lateribus anguste marginatis (thoracis impressionibus interdum obsoletis). *Elytra* lævia aut rarius rugulosa, punctato-striata, striis sæpe plus minusve deletis. *Pedes* mediocres; *coxis* anticis transversis, non aut vix elevatis; *femoribus* posticis valde incrassatis, subtus canaliculatis, ♂ interdum subtus unispinosis; *tibiis* ejusdem paris curvatis, extrorsum plus minusve flexuosis, dorso planis aut canaliculatis, plerumque tricostatis, apice bilobatis, spina valida armatis; *tarsis* posticis tibiæ apici insertis; *unguiculis* appendiculatis.

Type, *Arsipoda Chrysis,* Oliv. Australia.

It will be seen from the above diagnosis that I have been obliged to modify slightly the characters of this genus as originally laid down by Erichson, in order that it may receive a number of allied species which have the strongest affinity with Erichson's type, and form conjointly a most natural generic group. I have drawn up the diagnosis of the genus from *A. Lownei, A. Chrysis,* and several other species in which all the characters above given are always present; in some of the other

species some one or other of these diagnostic marks are frequently absent. The greatest amount of divergence from the typical form occurs in the grooves of the thorax and the striæ of the elytra: thus in *A. bifrons,* Erichson's type (which, according to my views, is an aberrant form of the genus), the basal grooves are only represented by faint notches, and the transverse sulcation is entirely absent; the striæ of the elytra in the same species are also visible only near their extreme lateral border. In *A. nitida,* Waterhouse, the thorax is entirely free from impressions, whilst the striæ of the elytra are only to be seen on the hinder half of the disk; again, in *A. rugulosa* the striæ are entirely obsolete, the general surface of the elytra being irregularly punctured and rugulose. Between these extremes and the typical species every degree of variation exists; it will therefore be seen that any attempt to divide these insects into genera, dependent on the presence or absence of the grooves of the thorax or the striæ of the elytra, is utterly futile, the arrangement of Illiger, so useful and complete in reference to European genera, breaking down entirely when applied to exotic forms.

Tabular Arrangement of the Australian Species.

I. Corpus fulvum.
A. Elytra distincte punctato-striata .... *variegata,* Waterh.
B. Elytra minus distincte punctato-striata, striis interdum obsoletis.
a. Corpus breviter ovatum .... *ovata,* Waterh.
b. Corpus anguste ovatum .... *attenuata**, Waterh.
II. Corpus metallicum aut nigrum.
A. Thorax et elytra lævia, non rugulosa.
A. Antennæ breves, subincrassatæ .... *crassicornis,* Waterh.
B. Antennæ longiores, filiformes.
a. Impressiones basales thoracis obsoletæ.
* Thorax metallicus.................... *nitida,* Waterh.
* Thorax rufo-fulvus .... *fulvicollis,* n. sp.
b. Impressiones basales thoracis semper plus minusve distinctæ.
† Sulcus transversus thoracis obsoletus.
* Corpus nigro-piceum .... *bifrons,* Erichs.
* Corpus metallicum .... *femorata,* n. sp.
†† Sulcus transversus semper plus minusve distinctus.
* Thorax fulvus .... *bicolor,* Waterh.
* Thorax metallicus.
‡ Sulcus curvatus faciei medio interruptus .. *consuta,* Germ.
‡‡ Sulcus curvatus faciei integer.
§ Corpus elongato-ovatum .... *Chrysis,* Oliv.
§§ Corpus breviter ovatum, crassum.
‖ Abdominis apex fulvus .... *MacLeayi,* n. sp.
‖‖ Abdominis apex basi concolor ...... *Lownei,* n. sp.
B. Thorax et elytra rugulosa .... *rugulosa,* n. sp.

* Mr. Waterhouse has described the sexes of this species under two

Arsipoda fulvicollis.

A. elongato-ovata, postice paullo attenuata, convexa, pallide picea; antennis extrorsum, vertice abdomineque nigris; thorace obscure fulvo; elytris cupreo-æneis, tenuiter punctato-striatis, striis ante medium indistinctis, interspatiis distincte punctatis, pone medium convexiusculis.

Long. $2\frac{1}{2}$ lin.

Hab. Adelaide.

Face irregularly wrinkled, vertex finely but not very closely punctured; antennæ moderately robust, shorter than half the length of the body, slightly thickened towards their apex; basal four joints pale piceous, the rest black. Thorax twice as broad as long, sides narrowed and rounded from base to apex, anterior angles thickened; surface of disk very finely and rather closely punctured; impressions of thorax obsolete. Elytra subparallel in front, slightly narrowed posteriorly, their apex rounded; surface finely punctate-striate, the punctures placed irregularly on the striæ; interspaces impressed with punctures nearly equal in size to those of the striæ themselves: these render the rows on the anterior half of the disk confused and difficult to define; on the hinder disk, where the striæ are slightly sulcate and their interspaces rather convex, they are much more distinct. Under surface of body clothed with coarse griseous hairs.

Arsipoda femorata.

A. elongato-ovata, postice paullo attenuata, cupreo-ænea, nitida, subtus piceo-ænea; antennis (basi obscure fulva excepta) pedibusque nigris; femoribus fulvis; thorace crebre punctato, basi utrinque impresso, sulco transverso obsoleto; elytris cupreo-violaceis, tenuissime punctatis, distincte punctato-striatis, striis postice deletis; tibiis posticis extrorsum vix curvatis.

Long. $2\frac{1}{4}$ lin.

Hab. Adelaide.

Narrowly ovate, slightly narrowed towards the apex; front flattened, slightly depressed, distinctly punctured; antennæ scarcely longer than half the body, robust, subfiliform. Thorax about twice as broad as long; sides narrowly margined, obliquely converging and slightly rounded from base to apex; anterior angles thickened, obtuse; surface closely and distinctly punctured, basal margin impressed on either side with a short, deep, slightly curved longitudinal groove. Elytra ovate, narrowed

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names, *substriata* and *attenuata*: the latter being the ♂, I have retained that name for the species. The ♂, like the same sex of *Arsipoda bifrons*, has the hinder femora toothed beneath: this is probably also the case with some of the other species; but, unfortunately, most of them are known to us by single specimens only.

behind, their apex acutely rounded; above convex, impressed longitudinally within the humeral callus; whole surface very finely punctured; the usual striæ are distinct and visible along the anterior half of the suture, and on the anterior portion of the outer disk; over the remainder of the surface, they are entirely obsolete. Hinder thighs strongly thickened.

Arsipoda MacLeayi.

A. late ovata, valde convexa, crassa, cæruleo-viridis, metallica; antennis (basi obscure fulva excepta), pedibus quatuor anterioribus, tibiis tarsisque posticis piceo-nigris, abdominis apice rufo-fulvo; thorace tenuiter punctato, basi utrinque profunde impresso, sulco transverso integro, medio sinuato; elytris fortiter punctato-striatis, striis usque ad apicem distinctis, ad latera et apicem versus leviter sulcatis, interspatiis subremote punctatis, planis, ad latera et ad apicem convexiusculis; tibiis posticis leviter extrorsum flexis.
Long. 2 lin.

Hab. Sydney.

Short, thick; facial ridge moderately raised and thickened; front smooth, not depressed, its lower part very obsoletely punctured; facial groove very deeply impressed, facial plates narrow, almost linear; antennæ half the length of the body, moderately robust, nearly filiform, being scarcely thickened towards their apex. Thorax more than twice as broad as long, sides obliquely converging and slightly rounded from base to apex, anterior angles obliquely truncate, incrassate; surface finely but not very closely punctured; base impressed on either side with a deep, slightly curved, longitudinal groove; transverse groove distinct, its middle sinuate and obtusely angled towards the basal margin. Elytra broader than the thorax, ovate, their apex rounded; upper surface impressed just within the humeral callus with an ill-defined curved groove, which bounds the lateral margin together with the outer half of the hinder border of the basilar space; striæ deeply punctured, sulcate on the outer border and towards the apex; interspaces distinctly punctured, plane, obsoletely convex towards the sides and apex.

Arsipoda Lownei.

A. crassa, ovata, obscure viridi-ænea, nitida; capite thoraceque cupreis, violaceo micantibus; antennis nigris, articulis 3^{tio} et 4^{to} obscure fulvis; thorace tenuissime punctato, basi utrinque profunde impresso, distincte transversim sulcato; elytris regulariter punctato-striatis, striis fortiter impressis, ad latera et apicem versus sulcatis, interspatiis tenuiter punctatis, antice planis, postice et ad latera convexiusculis; tibiis posticis extrorsum vix curvatis.
Long. $2\frac{1}{2}$ lin.

Hab. Sydney. Collected by Mr. Lowne.

Regularly ovate, robust; antennæ rather longer than half the body, slender, filiform, scarcely thickened at their apex. Thorax more than twice as broad as long; sides narrowly margined, very slightly rounded, and converging from base to apex, anterior angles thickened; upper surface very minutely punctured; the usual longitudinal impression on either side at the base strongly marked, transverse groove distinct. Elytra rather broader at their base than the thorax, ovate, slightly narrowed towards their apex, very convex, impressed within the humeral callus with a curved semicircular depression. Hinder thighs strongly thickened, unarmed beneath.

Arsipoda rugulosa.

A. anguste ovata, modice convexa, obscure fulva, nitida; antennis extrorsum nigris; pectore, abdomine femoribusque posticis (basi prætermissa) obscure piceis, vertice elytrisque cupreo-æneis; thorace fusco-æneo.

Long. $2\frac{1}{2}$ lin.

Hab. Melbourne.

Facial ridge very broad, scarcely raised; facial plates transverse, separated from the front by an indistinct transverse groove, vertex minutely granulose: antennæ scarcely equal to half the length of the body, slightly thickened towards their apex; four basal joints, together with the bases of the fifth and sixth, fulvous—the first four stained above with piceous. Thorax more than twice as broad as long; sides slightly rounded, converging from base to apex; anterior angles obliquely truncate, slightly reflexed; upper surface irregularly excavated on the sides, closely rugulose, impressed a short distance in front of the basal margin with a faint transverse groove, which does not extend to the lateral border. Elytra rather broader than the thorax, irregularly punctured, their whole surface covered with irregular transverse rugæ.

L.—*On the Cocoa-nut of the Seychelles Islands, or Coco-de-Mer.* By Mr. George Clark, of the Seychelles.*

The Coco-de-Mer is undoubtedly the most remarkable plant in this colony and its dependencies, one of which is the only spot in the world in which it is indigenous. The fruit was known long before the plant which produces it, or the locality in which it is found; and various fables were invented as to its origin, and marvellous virtues were attributed to its qualities. The few known specimens of it which existed were valued at an enormous price till, in 1742, the discovery of the Seychelles archipelago made known the habitat and nature of this singular production.

* Communicated by Dr. Bond.

The name "Coco-de-Mer," or Sea Cocoa-nut, was given in consequence of the first specimens of it which were known having been found floating in the sea, into which they had been carried by the streams; and some of these having been met with in the neighbourhood of the Maldive Islands, their name was added to that of Coco-de-Mer. When the Seychelles archipelago was discovered, three of the islands composing it, Praslin, Curieuse, and l'île Ronde were covered with magnificent forests of this unique palm, and their soil strewed with its huge and singularly shaped nuts. The value of their shells as domestic utensils for various purposes was at once perceived; and from that time to the present they have supplied to the inhabitants the place of buckets, bowls, jars, dishes, measures for grain and liquids, drinking-vessels, paint-pots, &c.; and they were extensively used among the labouring population of Mauritius until the diminution of the plant, and the great demand for the fruit which has arisen within the last few years in India and Persia, greatly enhanced their value.

The palm which produces this singular nut is the only member of its genus. Its systematic name is *Lodoicea Seychellarum.* It may be termed an equatorial plant, the islands on which it is found lying between 4° 15′ and 4° 21′ S. lat., and 55° 39′ and 55° 49′ E. lon. Its stem attains a height of 80 or 90 feet, and is quite straight, cylindrical, and smooth, but slightly marked throughout its length by the scars left by its fallen leaves. These scars are naturally more or less distant from each other, according to the rapidity of the growth of the plant. On the barren hill-sides they are scarcely 2 inches apart, while in the moist and fertile gorges they are as much as 3. The diameter of the stem varies, from the same causes, from 12 to 15 inches. A stalk so long and slender, crowned by leaves of vast size and strength, is necessarily much influenced by the wind; and in strong breezes the plants bend considerably, while their elasticity causes them to wave in the most graceful manner. The clashing of the leaves in a stiff gale produces a louder noise than I have heard from any other trees, and quite of a different nature; and the occasional fall of the ponderous fruit renders a passage among the Sea Cocoa-nuts a somewhat dangerous affair except in calm weather. I have heard of an instance of a woman's being struck by one while washing at a brook. A companion who was washing beside her was only made aware of the circumstance by the fall of the nut: the victim died without a cry or groan.

The stem of this, like other palms, consists of a mass of hard fibres, enclosing a medullary substance; but the fibrous portion of the stalk of the Coco-de-Mer is harder than that of any other

palm I know, and can only be cut by a sharp and well-tempered tool. The form of the stem likewise resembles that of most members of its family, its largest portion being that which rests on the surface of the ground. The root is in some cases bell-shaped, in others nearly hemispherical; and a vast number of rootlets radiate from it in all directions except upwards. These extend to a great distance around it, and form admirable stays to resist the strain to which the play of so long a lever subjects them; and so well do they perform their office, that I have never known an instance of a Coco-de-Mer having been blown down. I am aware that the same disposition of the roots exists in most other palms; but this by no means lessens the admiration due to such a perfect adaptation of means to an end. The rootlets are cylindrical, from half to three-quarters of an inch in diameter, and consist of a very hard bark enclosing a soft parenchyma. A beautiful exhibition of the roots is afforded where the palms have been burnt. The charred roots, almost as sonorous as metal, and as brittle as glass, show the great proportion of silex which they contain; and the numerous little tubes which radiate around have been left empty by the decay of the medullary substance which filled them. I have seen some instances in which the radius of these rootlets exceeds 12 feet. The leaves of the *Lodoicea* are winged and palmated, and bear a great resemblance to those of the Fan Palm. They are largest at the time when the stem is just appearing above the ground; and in favourable situations they may be found as much as 15 feet long (exclusive of the petiole, which is of an equal length) by 12 feet wide. As the trunk increases in height, the length of the petiole and the size of the leaf diminish. Did they not do so, the strength of the stem and its supports, great as it is, could not resist the effects of the wind with so great a leverage as the lofty stem would give. The leaves are destitute of prickles. The petiole is stout and grooved from its base to the leaflets, the folds of which converge to this canal, thereby pouring all the moisture which falls on them upon the stem. The edges of the petiole are sharp, and its base spreads so much as to embrace about two-thirds of the circumference of the stem; and some fibrous filaments, which spring from the lower part of the petiole, assist in maintaining it in its position. The middle of the petiole presents a longitudinal fissure, which appears like an accidental cleft: of this we shall presently see the use. The petiole is so strong, and so firmly attached to the stem, that a man may safely sit on its extremities, and even swing upon it. I only knew one man who would venture on this perilous feat. He was a native of the Maldive Islands, settled at Seychelles; and among all the perilous gymnastics I ever beheld, none made me

shudder more than to see him seated on the leafstalk of a Coco-de-Mer, at nearly 100 feet from rocky ground, rising and falling to the utmost extent the flexibility of the stalk allowed. He never met with any accident. The leaflets are of a glossy dark green on the upper side, and whitish green, slightly pubescent, on the under. They form a sharp fold, and are adherent in the greatest part of their length, the free ends growing longer as they recede from the centre of the leaf. The number of leaflets varies considerably; some fronds have upwards of ninety. Each fold is strengthened by a strong rib or nerve. The texture of the leaf is very strong, and of a complicated formation; it consists of three layers of fibres, enveloped in parenchyma. The two outer layers are longitudinal, and the centre transverse, and the epidermis itself is very strong. When the parenchyma and epidermis have decayed, the exposed fibres present much the appearance of coarse Scotch gauze. The leaf, previous to its unfolding, is covered with a thick fawn-coloured down, of a cottony feel. When the trees were numerous, this down was collected in sufficient abundance to form the stuffing of mattresses and pillows for the Praslinois. The most attentive observation leads to the belief that one leaf is produced every year, and from the scars left by their fall the age of the tree may be computed. Reckoned by this standard, some of the trees must be nearly four hundred years old.

The male and female flowers are produced on separate trees. The spadix which supports them springs from the same circle of insertion as the leaf which accompanies it; but, instead of rising from the axil of the leaf, it passes through the fissure of the petiole. The spathe, in both, is composed of three fibrous bracts, fitting one into the other, and opening by a longitudinal fissure on the outer side. The first bract, and generally the second, are concave on that side which is against the tree. The top of the first bract forms a sharpish edge; that of the second is pointed, and remains fixed between the tree and the upper part of the fissure of the petiole, thus supporting the weight of the spathe, while the top of the third bract, which is also pointed, is free. In the male flowers, the spathe is terminated by a catkin of 2 or 3 inches in diameter, and sometimes nearly 4 feet long, cylindrical, and rounded at the end. It is covered with brown scales closely imbricated, but so sloped at the ends as to allow the flowers to issue. These openings form symmetrical spiral lines round the catkin. A transverse fracture of the latter exhibits a series of reticulated tubercles, radiating from the axis to the circumference. These tubercles, which are nearly the shape of a Nautilus-shell, consist of an assemblage of about twenty sessile blossoms in various degrees of maturity, and form

a reserve in the interior of the catkin. They appear one or two at a time at the floral opening, to blow and fall in their turn. This most curious arrangement prolongs the blossoming of a catkin to the unequalled period of six or eight years. The calyx of these flowers is prismatic and entire, and slightly cleft into three unequal lobes. The corolla is composed of three little linear petals, concave at their extremity, and alternating with the divisions of the calyx. The stamens are from twenty to thirty in number, and the anthers slightly sagittiform. The pollen is yellow, and, seen through the microscope, appears much like grains of barley, not only in shape, but also in being furrowed longitudinally—a form common, I believe, to the pollen of palms in general. A gummy exudation, of a rather strong and peculiar smell, covers the surface of the catkin. In the female flowers the spadix is simple, as in the males; but, instead of growing in a straight line, it forms a zigzag, from the angles of which the flowers spring. These flowers are about 3 inches in diameter. The calyx is sessile, and is formed of two circles of bracts, three in each circle, firmly imbricated, and almost enclosing the ovary previous to its fecundation. The calyx is attached to the spadix by two oval bracts; but these remain attached to the spadix, while the calyx falls with the fruit. The flower has neither corolla nor style. Three sharp, persistent, sessile stigmas rest on the top of a fibrous drupe, generally a little compressed vertically, two-, sometimes (but rarely) three-sided—in the former case containing a 2-lobed nut, in the latter a 3-lobed nut. It also sometimes happens that two 2-lobed nuts are contained in the same drupe, and this is less rare than to find one with three lobes. This drupe attains a length of upwards of 15 inches, and a circumference of more than 3 feet, weighing from forty to fifty pounds.

About three years after fecundation the fruit has attained nearly its full size, and is then called *Coco tendre.* It may, in this state, be easily cut through with a knife, and exhibits in an interesting manner the different substances of which it is composed. First externally is the drupe itself, green on the outside and whitish within, of a harsh taste and astringent quality, like that of the ordinary cocoa-nut. Next comes what will form the hard shell of the nut. This is lined with a layer of a white feculent substance, almost tasteless. This covers a yellow matter, very bitter and said to be poisonous, which envelopes the perisperm, a jelly-like mass, presenting much the appearance of cold starch very slightly tinged with blue. This has a sweetish taste, and is considered cooling, and is much esteemed by the Seychellois. In the centre of this, at the point of junction of the two lobes, lies the embryo. In the mature state, which is not till seven or

eight years after the fecundation, the drupe has become fibrous, and from a rich dark green has turned to a reddish yellow, and falls from the stem. Germination takes place sometimes before, sometimes after, the fall of the fruit, the shell of which is hard and black, and marked all over by traces of the fibres which were inserted in it; and a bunch of these fibres, much resembling coarse black hair, remains in the orifice from which the germ sprouts. The yellow bitter substance has become a leathery skin, enclosing the perisperm; and the soft jelly-like mass has been condensed into a tasteless kernel, as hard as beech-wood, of a pure white colour, leaving a large cavity in each lobe of the nut; and at the point of junction of the two lies the embryo, of turbinated form. The germ, in passing through the orifice mentioned, becomes fibrous, assumes a club-shape, and curves towards the ground, which it penetrates. The radicle descends vertically, and from it sprout the rootlets. At a depth of 2 or $2\frac{1}{2}$ feet sprouts a fibrous leaf, at an angle of about forty-five degrees. This leaf seems to perform the office of a cotyledon to that which follows it, and which springs from its side. Each succeeding leaf becomes larger, and approaches more nearly to a vertical direction, till the crown is formed, when they succeed each other in the usual way. The trunk does not show itself till twenty or twenty-five years after the germination of the nut; and fourteen or fifteen years from this period the plant is in its greatest beauty, and begins to blossom. As many as eight or ten spadices may be seen on a tree at the same time, the male flowers, as has been said, retaining their bloom; and the female flowers seem to have the power of waiting an indefinite period for fecundation. Six or seven full-sized drupes may be sometimes seen on one spadix; but although as many as eight female flowers may be seen on one stem, it is rare to see more than three or four arrive at maturity. Imperfect fecundation often takes place, and a partial development of the drupe goes on. In this case it becomes deformed, assumes a curved shape, and falls a useless abortion. The Coco-de-Mer grows in every kind of soil, but attains its greatest size and beauty in the deep moist gorges of the mountains, where a rich bed of humus favours the growth of that as well as of other palms, some of which greatly surpass it in height. By the sea-side, and in situations much exposed to the wind, the Coco-de-Mer presents a somewhat barren aspect; its leaves, being renewed so slowly, are withered and rent, and the trees might be supposed to be dying. It has been observed that, at the discovery of the islands which produce it, vast forests of the Coco-de-Mer existed. The height and smoothness of the trunk rendered it a less difficult matter to cut down a high tree than to climb it, to obtain its fruit; and

thousands have thus wantonly been destroyed; so that a few years ago hundreds of male trees might be found without a single female among them. Many fires have also occurred in these woods, and a vast number have been destroyed in the conflagrations which have taken place. Five or six years ago a fire broke out at Praslin, which continued for several weeks, blazing up again and again after it was thought to be extinguished; and by this a very considerable number of these trees perished. On l'île Ronde not a plant remains. Curieuse, occupied as an establishment for the treatment of lepers, has a considerable number of fine young trees; and as this is government property, it is to be hoped that strict injunctions will be given to preserve every remaining tree, and also to plant others. If this be not done, it is not improbable that a few generations hence this unique and interesting palm will no longer be found. Its extremely slow growth has prevented most persons from planting it. There are not perhaps a score of trees in all the islands, except in Praslin and Curieuse. The growth of many young plants is stopped by cutting out the unopened leaves as fast as they appear, for the making of hats and other objects. These are called *cœurs-de-cocos*, and are very pretty objects. The leaflets are so compactly packed together that they seem to form a solid mass, as smooth as ivory. Their edges are of a most beautiful delicate green, and the lamina of a clear pale straw-colour. They form a material of unequalled quality for the making of hats and bonnets; and could they be supplied in sufficient quantity, a large trade in them might be carried on. A large bonnet-maker in England, who cleaned some for a lady from Seychelles, was particularly struck with the excellency of the material of which they were made, and said she could ensure a ready sale for any quantity of it. The splitting of the leaflets into strips of the desired breadth is a much more difficult affair than straw-splitting, on account of the transverse fibres which cross it. This operation is performed with considerable skill by those accustomed to it. They employ a simple little machine made of a piece of hard wood, with a sharp blade fixed in it. This blade is set at the required distance from a raised edge, which determines the width of the strip, and keeps it straight. The strips, however fine, can only be cut singly. Very useful and pretty little baskets, called *tentes*, are also made of these leaves. They last for many years, and by washing and bleaching may be always restored to their original colour. It is cut out into various tasteful patterns, and made into fans, which are much admired for their lightness and durability. Artificial flowers are also made of it, which want nothing but colour to be a good imitation of nature. Work-baskets (*corbeilles*) of great

beauty and in great variety are made by some of the Seychelles ladies, and some of these productions obtained much admiration and a prize at the Great Exhibition of 1851. The nerve which strengthens each leaflet is employed to stiffen hats made of the leaf, each seam of the rows of plat being sewed over it. This may also be split into fibres as fine as hair, and possesses considerable tenacity. I have seen a little basket of very complicated and delicate structure made of this material. It was manufactured by a lady of the Vendries family, which is unrivalled for the taste and skill displayed in the articles made from the Coco-de-Mer by its members. Mats of great beauty and unequalled durability are also made of these leaves. The extreme hardness and smoothness of their surface, and the length and strength of their fibres, are unrivalled by any substance within my knowledge. The expanded leaf forms an excellent thatch, nearly equal to shingles in durability. Its strength is so great that, when pinned together with little skewers of bamboo, it forms a basket capable of bearing nearly a bushel of fruit.

The petiole forms a strong and durable paling, and is also sometimes used for small rafters. The trunk, when cut into lengths and split into palisades, is used instead of boards for the sides of houses, and will last, I believe, as long as any wood. When split in two and hollowed, it is used for gutters for conveying water, and is almost imperishable. The size of the nuts varies greatly : I have seen some which would not hold a bottle, and others which were sixteen times as large. These extremes are rare; but a nut of ordinary size will hold from six to eight bottles. When intended to be preserved whole, they are left in a damp place till the perisperm has rotted away—a process which requires many months to complete: during this process it not unfrequently happens that flat-shelled snails introduce themselves into the nut, and grow too large to get out by the hole by which they entered, and die there, like the weasel in the fable. They are then called *Cocos légers*. They are then pierced with an auger at one end, or the extremity is sawn off; the orifice through which the germ sprouts is stopped up with a little pitch, and a withe round the cleft converts it into a convenient bucket, strong and light. When sawn longitudinally, it forms an elliptical vessel, called *Coco scié,* superior to everything else for baling out boats.

Three-lobed nuts are sometimes met with. I have possessed one with five lobes, and have heard of one having as many as seven. The kernel of the *Lodoicea* contains a portion of oil; but its excessive hardness, and the difficulty of detaching it from the shell (itself so valuable), render it practically useless for oil-

manufacture. The shell is about equal in hardness to that of the ordinary cocoa-nut, and equally susceptible of a fine polish. It is from $\frac{1}{10}$th to $\frac{3}{16}$ths of an inch in thickness.

The foregoing simple account of the *Lodoicea Seychellarum* proves it to be a most interesting plant in a scientific point of view, and a very valuable one in an economical one. It is therefore well worthy of the attention of the Government, as well as of private individuals, to use means, not only to prevent its extinction, but to favour its propagation.

At a recent meeting of the Linnæan Society (Nov. 3) letters were read from Sir H. Barkly, K.C.B., Governor of the Mauritius, and from Swinburne Ward, Esq., Civil Commissioner, in reply to the memorial of the Linnean Society relative to the wanton destruction of the Coco-de-Mer (*Lodoicea Seychellarum*). The Commissioner had reported to his Excellency that, although in many parts where the palm abounded it has been destroyed by accidental conflagration and by ruthlessly cutting it down to make room for Mandioc cultivation, yet that on the southern point of the island of Praslin he had found a valley surrounded by hills on the property of Mr. Campbell, the sides and crests of which were covered with the *Lodoicea*, several hundred in number, and in all stages of growth, from the sharp sword-shaped spathe just shooting from the ground to trees of 120 feet high. He ascertained that though no nuts were planted, some were allowed to remain and take root where they fell. The leaves of the male plants are cut for the sake of the material they afford, and which is used for making hats and baskets; but those of the male only, which preponderates over the female, are so cut. Cutting the leaves prevents the blossoming of the trees; but inaccessible specimens, which flower undisturbed, are quite sufficient to fecundate all the female plants in the district. In Curieuse comparatively few trees were found, and these smaller than those of Praslin; but directions have been given to keep up the supply by planting germinating nuts—in fact, to plant all the germinating nuts that can be found. A Coco-de-Mer with a healthy germ a foot long had been forwarded to Kew. The Governor stated that, as Praslin is almost entirely private property, the Government could only interfere in the way of exhortation and remonstrance, but that in Curieuse, which is still vested in the Crown, and used for a purpose which renders it inaccessible to the public, he trusted there would be no danger, under any circumstances, of the extinction of this interesting species.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 8, 1864.—D. J. E. Gray, F.R S., in the Chair.

Description of a New Species of Staurotypus (S. Salvinii) from Guatemala. By Dr. J. E. Gray, F.R.S., etc.

Among the interesting series of Tortoises brought by Mr. Salvin from Haumanchal, Guatemala, and deposited in the British Museum, are two specimens of a Tortoise of the genus *Staurotypus*, but differing from the normal form of that genus in the sternum being narrowed and acute in front, like the sternum of *Chelydra*, which genus it resembles in having a crested though short tail.

I would propose to divide the genus thus:—

A. *Sternum broad and truncated in front.* Staurotypus.

1. Staurotypus triporcatus, Gray, Cat. Shield Rept. B. M. 47, t. 20 *b*.

Hab. Mexico (*Wiegmann*); Vera Cruz (*Sallé*).

B. *Sternum narrow, tapering, acute in front.* Stauremys.

This subgenus has the form of the sternum and the crested tail of *Chelydra*, with the sternal shields of *Staurotypus*.

2. Staurotypus (Stauremys) Salvinii.

Hab. Haumanchal, Guatemala (*Salvin*).

Head very large, swollen, crown covered with a thin soft skin; face conical, rather produced; nose terminal; mouth inferior; beak large, dentated on the edge; chin with two beards; throat warty; skin of body and limbs granular; the fore legs have several slender, very broad, arched, band-like shields across the inner side, the middle one being the broadest; toes well developed, strong; upper surface covered with a single series of band-like shields, united to the claws by a wide, well-developed web; claws 4—5, strong, elongate, acute; tail short, conical, angular above, with a central and lateral series of tubercles, forming three short crests; the thorax oblong, covered with three short, continuous keels; marginal shields rather narrow, elongate; sternum cross-like, small compared with the dorsal disk, narrow, slightly rounded before, acute behind, united to the dorsal disk by a narrow lateral process; sternal plates seven, thin, four pairs and a single odd one behind; the first pair elongate, longer than broad (probably the first two pairs of other *Emydæ* united); the second pair broad, produced on the side, so as to cover the greater part of the cross-like sternum; the third pair elongate, narrow; the hinder plate rhombic, rather longer than broad, acute in front and behind; the axillary and inguinal plate large, covering the space between the outer lateral edge of the second pair of shields and the marginal plates. The front lobe of the sternum is very moveable at the suture between the first and second

pairs of sternal plates, in the young specimen, and has a considerable amount of mobility in the adult specimen.

The shell is brown; the head is dark olive; the temple and the side of the neck pale-marbled; underside of the limbs whitish.

Wagler represents the anal shields of *S. triporcatus* as divided. In the large specimen in the British Museum they are united into a single rhombic shield, as in *S. Salvinii*.

Remarks on a Species of Shell belonging to the Family Dentaliidæ. By W. Baird, M.D., F.L.S.; with Notes on their Use by the Natives of Vancouver's Island and British Columbia, by J. K. Lord, F.Z.S.

Amongst the objects of natural history and ethnology brought from Vancouver's Island and British Columbia by Mr. Lord is a belt composed of numerous specimens of a species of *Dentalium* strung together. The species bears an exceedingly close resemblance to that described by Linnæus as *Dentalium entalis* (*Entalis vulgaris* of Risso and of Dr. Gray's 'Guide to Mollusca'), and appears to me, notwithstanding the difference of habitat, to be undistinguishable from that European species. It has, however, been described by the late Mr. Nuttall as *Dentalium pretiosum*; and a figure has been given of it by Mr. Sowerby in one of his late Numbers of the 'Thesaurus Conchyliorum.'

From a careful comparison of the typical specimens of *D. pretiosum* in Mr. Cuming's collection, there can be no doubt of the identity of that species with the specimens brought by Mr. Lord from Vancouver's Island; those in Mr. Cuming's collection are said to be from California. In examining the old graves on the banks of the Columbia River, along with numerous other articles, such as human bones, flint instruments, &c., Mr. Lord found a number of specimens of a species of *Dentalium* considerably eroded and worn, which I have compared with some in Mr. Cuming's collection, and find identical with the *Dentalium striolatum* of Stimpson, from Newfoundland. I strongly suspect that both this species (*D. striolatum*) and *D. pretiosum* are only very slight varieties of the old Linnæan species *Dentalium entalis* (*Entalis vulgaris*). The habitats of all three (species?) are very different from each other; but, notwithstanding this, in the absence of distinct specific characters, I should hesitate very much in making distinct species of them. However that may be, the history of the specimens brought by Mr. Lord is very interesting; and these few observations must be considered only as introductory to the very instructive notes drawn up by that gentleman, a perusal of which will prove the best apology for these brief preliminary remarks.

Notes on the above, by Mr. J. K. Lord.

It is somewhat curious that these shells (*Entalis pretiosus*, Nuttall, sp.; *Entalis vulgaris*?) should have been employed as money by the Indians of North-West America—that is, by the native tribes inhabiting Vancouver's Island, Queen Charlotte's Island, and the

mainland coast from the Straits of Fuca to Sitka. Since the introduction of blankets by the Hudson's Bay Company, the use of these shells as a medium of purchase has to a great extent died out, the blankets having become the money, as it were, or the means by which everything is now reckoned and paid for by the savage. A slave, a canoe, or a squaw is worth in these days so many blankets; but it used to be so many strings of *Dentalia*. In the interior, east of the Cascade Mountains, the Beaver-skin is the article by which everything is reckoned—in fact, the money of the inland Indian.

The value of the *Dentalium* depends upon its length: those representing the greater value are called, when strung together end to end, a "Hi-qua;" but the standard by which the *Dentalium* is calculated to be fit for a "Hi-qua" is, that twenty-five shells placed end to end must make a fathom, or six feet, in length. At one time a "Hi-qua" would purchase a male slave, equal in value to fifty blankets, or about £50 sterling. The shorter and defective shells are strung together in various lengths, and are called "Kop-kops." About forty "Kop-kops" equal a "Hi-qua" in value. These strings of *Dentalia* are usually the stakes gambled for.

The shells are generally procured from the west side of Vancouver's Island, and towards its northern end; they live in the soft sand, in the snug bays and harbours that abound along the west coast of the island, in water from three to five fathoms in depth. The habit of the *Dentalium* is to bury itself in the sand, the small end of the shell being invariably downwards, and the large end close to the surface, thus allowing the fish to protrude its feeding- and breathing-organs. This position the wily savage has turned to good account, and has adopted a most ingenious mode of capturing the much-prized shell. He arms himself with a long spear, the haft made of light deal, to the end of which is fastened a strip of wood placed transversely, but driven full of teeth made of bone, resembling exactly a long comb with the teeth very wide apart. A squaw sits in the stern of the canoe and paddles it slowly along, whilst the Indian with the spear stands in the bow. He now stabs this comb-like affair into the sand at the bottom of the water, and after giving two or three stabs draws it up to look at it; if he has been successful, perhaps four or five *Dentalia* have been impaled on the teeth of the spear. It is a very ingenious mode of procuring them, for it would be quite impracticable either to dredge or net them out; and they are never, as far as I know, found between tide-marks.

At one period, perhaps a remote one, in the history of the inland Indians these *Dentalia* were worn as ornaments. I have often found them mixed with stone beads and small bits of the nacre of the *Haliotis*, of an irregular shape, but with a small hole drilled through each piece, in the old graves about Walla-walla and Colville. In all probability, these ornaments were traded from the coast Indians; but, as these graves were quite a thousand miles from the sea, it is pretty clear the inland and coast Indians must have had some means of communication.

March 22, 1864.—Dr. J. E. Gray, F.R.S., in the Chair.

Notes on the Didunculus strigirostris, or Tooth-billed Pigeon. By Dr. George Bennett.

Having fortunately obtained by purchase a living pair of those singular and rare birds, the Tooth-billed Pigeon (*Didunculus strigirostris*), which had been brought from the Samoan or Navigators' Islands to Sydney, New South Wales, an opportunity has been afforded to me of attentively watching their habits in captivity. To guard against the event also of these valuable birds dying, I availed myself of the services of Mr. C. Thomas, who made an accurate drawing of them from life in their most natural attitudes; and his drawing conveys an excellent idea of the peculiar expression of these remarkable birds when alive. I have sent a tracing of this drawing for insertion in the 'Illustrated London News;' and should the bird now on its way to England die, I shall be able to send the Society an accurate coloured representation of the living birds. The *Didunculus*, like the Dodo, has a very limited range, having only been found inhabiting the Samoan or Navigators' Islands. In the contour of the bill, the form and position of the nostrils, and several other characters, the *Didunculus* differs from any other living species at present known; and, although a smaller bird in size, it approximates the nearest in all its characters to the extinct Dodo, and, like it, combines the character of a rapacious bird with that of the harmless Pigeon. The Dodo also inhabited a very limited space of land, as the remains of that bird and allied genera have only been found on the small islands of the Mauritius, Bourbon, and Rodriguez. The *Didunculus* may therefore be regarded as the nearest living ally of the extinct Dodo. Although the mandibles of the *Didunculus* are powerful in structure, yet the beak is never used as an offensive weapon; for when the hand is placed in the cage, or the bird is seized for removal from one cage to another, it never attempts to bite the aggressor, but, on the contrary, is so timid, that after fluttering about or running into a dark corner of the cage in its efforts to escape, it soon becomes subdued and is easily taken.

In all the families of Pigeons a diversity in the form of the beak is found. In the Fruit-eating Pigeon the beak is stronger, stouter, and the corneous portion is strongly arched and compressed, bearing a great resemblance to the structure in certain rapacious birds; and this form of beak is carried to the greatest extent in the *Didunculus*, yet the living birds in captivity were never observed to crush hard seeds or nuts. They would nibble into minute bits the seeds of loquats, almonds, and hemp-seed, with the same action as observed in the Parrot tribe when feeding. When I first had the birds, boiled potatoes and stale bread formed their diet. The boiled potatoes were torn and swallowed in large pieces at a time, being soft; but the stale bread they would place their feet upon and tear with the hooked beak into small bits. A piece of apple was also eaten; but the bananas placed in the cage were never touched, although it is said that in a wild state they live on berries, and are very fond of the

mountain-plantain. Both the birds were regularly fed twice daily—early in the morning and about four in the afternoon. It was supposed at one time that these birds did not drink water; but I soon found that this assertion was incorrect.

It was early in June 1863 that the first *Didunculus* arrived at Sydney; and on the 15th of that month and following days I examined the bird, which I found in good health, very timid, and a young bird in immature plumage, and the teeth of the lower mandibles not yet developed. It was about the size of the Nicobar Pigeon, but rounder and more plump in form. It kept steadily looking at me during the time I was examining it, uttering occasionally a plaintive *coo, coo, coo,* or *goo, goo, goo.* This bird had been captured on the island of Upolu, not more than five miles from the settlement of Apia, by a native. It has now been in captivity for some time, and is considered to be at this time (January 1864) two years old. It has attained the full plumage of the adult bird, and the teeth of the lower mandibles are also fully developed. When any one approaches the cage, it will sometimes retire to an obscure corner, and at other times will remain quiet on the perch, watching attentively every movement of the spectator, and occasionally changing its position. It invariably feeds in the light, but will not do so if any one is present; the only opportunity we had of observing its mode of feeding was through the window, when the bird was placed in the verandah of the house, when we could watch its actions without being seen by the bird. It usually kept on the low perch, but when disturbed would sometimes jump on the ground, run rapidly about, and then take refuge in the darkest part of the cage. In its physiognomy it is a stupid-looking bird, with, at the same time, a remarkable peculiarity of expression, which the artist has succeeded in obtaining. The bird has nothing particular in its plumage to attract the attention of the common observer; but the head of a rapacious bird on the body of a Pigeon would excite the attention of the most ordinary spectator. The plumage of this bird is of a chocolate-red colour, deeper on the back, tail, and the primaries and secondaries of the wings, and barred over the breast, throat, and wing-coverts with light brown. The upper part of the head is rather bare of feathers, but those remaining are of a dark slate-colour. The base of the beak is of an orange-red, and the rest of the mandibles yellowish. The legs and feet are of a bright orange-red. The cere round the eyes is of a flesh-colour. The irides are of a dark reddish brown. The form of the beak and the bright eyes impart to the bird very much the character of a rapacious bird. The above is the state of the plumage in the young bird.

On the 24th of July another *Didunculus* was brought to Sydney from the Island of Savaii (one of the largest and most mountainous of the Navigators' group). I found it was a full-grown bird in adult plumage, with the teeth of the lower mandible well developed; the head, neck, breast, and upper part of the back was of a greenish black; back, wings, tail, and under tail-coverts of a chocolate-red. The legs and feet were of a bright scarlet. The mandibles

are of a bright orange-red, shaded off near the tip with very light yellow. The cere around the eyes is also of a bright orange-red colour; the irides brownish black. I was informed that these birds are nearly extinct, from having been formerly eaten by the natives in great numbers, and of late years from being destroyed by wild cats; and it is said that most of the Ground-Pigeons are following the fate of the *Didunculus*, from the same causes. Indeed, from my observation of the living birds, they are very timid and stupid. On the following day I examined the birds together. They are both moulting; and the young bird has grown very much since I last saw it, and is now larger in size than the adult specimen recently arrived. As there is no sexual distinction in the plumage, it is probable that size may be a distinguishing mark of the sexes; and if so, these birds may prove to be male and female. On the 21st of August I completed my purchase of these birds for a very high price. I must thank the Council of the Acclimatization Societies of Sydney and Melbourne for the liberal resolutions passed by them to unite with me in the purchase of these rare birds, on account of the very high sum demanded for them, and to join with me in presenting them to the Zoological Society of London; but, on mature reflection, considering the casualties to which they would be liable, I considered it would be more satisfactory to take upon myself the sole responsibility and expense. The adult bird often runs wildly about the cage, flapping its wings, and, when the door is open to receive food, makes every effort to escape. These birds run with great rapidity, elongating the body and depressing the head, and in the action of running resemble the Grouse. On the 12th of September the older bird refused food, which continued to the morning of the 14th of September, when several fits carried it off in the course of the day. I placed the bird entire in spirits, to enable a complete anatomical description of this bird to be given by my distinguished friend Professor Owen. The young bird seems tamer and more lively since the death of its companion; it is probable the old bird being so wild terrified it. I observed a quantity of white powder (epithelium) about the cage lately, and also discolouring the water; it resembled the same kind of powder often observed from the White Cockatoos. On the 4th of October the bird did not feed well; so we gave it some loquats (*Eriobotrya japonica*), a fruit naturalized and abundant in New South Wales. The bird enjoyed the change; it did not devour the pulp, but picked out the seeds, and cracked them into minute bits; what portion was eaten I could not ascertain, but a pint of loquats was used daily in this way, as well as occasionally a little boiled potato. On the 7th of October the *Didunculus* was in excellent health, and the plumage is very much changed, as the head, neck, and breast are now of a slate-colour tinged with dark bottle-green. The bill has become of a bright orange-red, and the legs are nearly a bright scarlet colour: the bird has evidently assumed the adult plumage. When the bird is seen, and does not perceive the observer, it leaps from the perch, runs about the cage, and then commences feeding; but on a visitor approaching, it again takes to the perch, and remains watching

the intruder, giving deep guttural growls, followed afterwards by a vibration of the whole body from the head to the tail, uttering at the same time its plaintive notes of *goo, goo, goo,* repeated in quick succession. On the 23rd of October, the bird looks well; it has not eaten for the last two days, but has taken a large quantity of gravel. We find the bird requires a large supply of that material for the purpose of aiding digestion. As it was considered the loquat-seeds might have disagreed with the bird, they were discontinued. On the 25th it appeared worse; and fearing it might die, I placed it in a Parrot-cage to enable the artist to finish the drawing from life, as in a cage of that description he could have a good view of the plumage, &c., over every part of the bird; when, to our great surprise, it jumped from the perch to the bottom of the cage and commenced eating what, on examination, was found to be hemp-seed; and from that time it has been fed on that kind of food. It soon regained its usual health, the diet of hemp-seed being occasionally diversified by some bleached almonds; stale bread is also placed in the cage, but it eats but very little, if any, of it. This circumstance points out the difficulty of arranging a diet for a bird with whose habits we are unacquainted, as at one time it thrives well upon a certain diet, on a sudden appears to be dying, and then becomes in good health from a change of food accidentally discovered, as in this instance. Since then, the *Didunculus* has continued in most excellent health; and has now just been placed on board the ship 'La Hogue,' Captain Williams, under the care of Mr. Broughton, the steward, from whose experience in the management of birds there is every chance of this rare bird arriving safe at its destination in the Gardens of the Zoological Society in the Regent's Park. 'La Hogue' sailed from Sydney early on the morning of the 12th of January, 1864.

The whole of the time the bird was in my possession it never became domesticated, nor evinced the slightest attachment to the lady who daily fed it: it was the same to her as to strangers; and I do not consider the *Didunculus* a bird that will be readily domesticated or reconciled to captivity. For some period of time this bird would be very tame comparatively, and then, without any apparent cause to account for the change, would become very wild. At that time the cleaning of the cage was attended with some difficulty, from its violent fluttering on any one approaching for the purpose, in which it evinced no little power of wing.

On a New Species of Smithornis. By George Robert Gray, F.L.S., etc.

I beg to call the attention of the Society to a new species of bird belonging to the interesting genus *Smithornis,* which was established by the late Prince Bonaparte on the *Platyrhynchus capensis* of Sir A. Smith.

It is characterized as follows, under the name of

Smithornis rufolateralis, sp. nov.

Head and occiput deep black; lores white; nape with a narrow

collar of orange-brown; back black, varied with white and orange-brown; scapulars and upper tail-coverts orange-brown; wing-coverts black, tipped with white; beneath the body white, but with the breast and sides of abdomen more or less streaked with narrow stripes of black along the shaft of each feather; each side of the breast with a patch of pale rusty colour. Upper mandible black, lower one yellow; feet pale horn-colour.

Length 4″ 6‴; wings 2″ 4‴.

This bird differs from the typical and only hitherto known species *Smithornis capensis* (Smith) in being of a smaller size, and in possessing a greater variety of colours.

The British Museum possesses, through Mr. Gould, a single specimen of *S. rufolateralis*, which was stated to have been brought from West Africa; but the exact locality is unknown.

On a Poison-organ in a Genus of Batrachoid Fishes. By Dr. Albert Günther.

Many fishes are known which, provided with long, bony, and sometimes serrated spines, are justly feared on account of the dangerous wounds they inflict. The Sting-Rays, many Siluroids, and some scaly fishes, like the Weevers, are thus armed. Although the effects ascribed to such wounds have doubtless been exaggerated in many cases, natives and fishermen, as well as travellers, agree in the belief that some poison must be communicated. However, with the exception of a single instance, viz. that of the Weevers*, comparative anatomists have never pointed out a trace of an organ secreting or conducting a poisonous substance; and consequently the poisonous nature of the wound has been doubted, the worst cases being explained by the mechanical effect of a serrated spine, by the influence of the climate, or by the peculiarity of the constitution. Thus in all the hand-books of comparative anatomy the presence of a poison-organ in the class of fishes is denied, and even Bleeker† (than whom no naturalist has had better opportunities of observing such fishes during life) expressly says that they were unjustly reputed poisonous.

* Dr. J. E. Gray has directed my attention to a paper by Mr. Byerley, contained in the Proceedings of the Literary and Philosophical Society of Liverpool, No. 5, 1849, p. 156. In this paper Mr. Byerley demonstrates, in the most convincing manner, that the double-grooved opercular and dorsal spines of the Weevers are poison-organs. Although the structure of the spines, with their external grooves, were known to previous writers, it is Mr. Byerley's merit to have shown the presence of a cavity within the substance of the spines which is the proper depository of the poison before its ejection. But, at present, I cannot agree with him that the body found in the cavity and in the groove is a gland; it appears to me that what he considered to be a gland was the poisonous fluid itself, coagulated and hardened by the action of the spirits in which the specimens had been immersed in order to render "the gland more opaque and denser." I formed this opinion from examinations of specimens of *Trachinus draco* as well as of *T. vipera*, which, however, had been in spirits for a considerable period. Nevertheless there is no doubt that the poison-apparatus of *Trachinus* is homologous with that of *Thalassophryne*, only in the latter it is developed to as great a perfection as in the fang of a viper.

† Atl. Ichthyol. Silur. p. 21.

On the other hand, I have heard of so many positive facts from highly educated travellers and excellent observers (some of whom, being medical men, had treated cases of this nature), that it appeared to me necessary to give every attention to this subject. Especially it seemed probable that a sac with a more or less wide opening in the axil of the pectoral fin of many Siluroid and of some other fishes would contain a fluid which might be introduced into a wound by means of the pectoral spine, which would be covered with it, like the barbed arrow-head of a bushman.

Whether this secretion is equally poisonous in all the species which are provided with that axillary sac is a question which can only be decided by experiments made in the tropics; but I can hardly doubt its poisonous nature, after discovering in a genus of fish a poison-organ which structurally is the same as in the venomous snakes. This genus, belonging to the family of Batrachidæ, was described by me in the Catal. Fish. iii. p. 174, with a single species, *Thalassophryne maculosa*. The typical specimen being small and having been in spirits for a long time, I did not observe the openings in the venom-spines, although I now perceive them to be present, as in the second species found by Messrs. Dow and Salvin, which I have described (in P.Z.S. 1864, p. 150) as *Thalassophryne reticulata*. The specimen is $10\frac{1}{2}$ inches long.

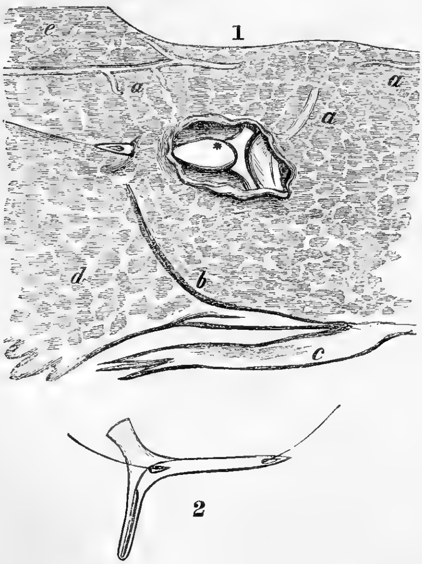

Fig. 1. Hinder half of the head, with the venom-sac of the opercular apparatus *in situ*. * Place where the small opening in the sac has been observed. *a*. Lateral line and its branches. *b*. Gill-opening. *c*. Ventral fin. *d*. Base of pectoral fin. *e*. Base of dorsal fin.

Fig. 2. Operculum, with the perforated spine.

The structure of the poison-organ is as follows:—

1. *The opercular part.*—The operculum is very narrow, vertically styliform, and very mobile; it is armed behind with a spine, eight lines long, and of the same form as the venom-fang of a snake; it is, however, somewhat less curved, being only slightly bent upwards; it has a longish slit at the outer side of its extremity, which leads into a canal perfectly closed, and running along the whole length of its interior; a bristle introduced into the canal reappears through another opening at the base of the spine, entering into a sac situated on the opercle and along the basal half of the spine; the sac is of an oblong-ovate shape, and about double the size of an oat-grain. Though the specimen had been preserved in spirits for about nine months, it still contained a whitish substance of the consistency of thick cream, which on the slightest pressure freely flowed from the opening in the extremity of the spine. On the other hand, the sac could be easily filled with air or fluid from the foramen of the spine.

No gland could be discovered in the immediate neighbourhood of the sac; but on a more careful inspection I found a minute tube floating free in the sac, whilst on the left-hand side there is only a small opening instead of the tube. The attempts to introduce a bristle into this opening for any distance failed, as it appears to lead into the interior of the basal portion of the operculum, to which the sac firmly adheres at this spot.

2. The *dorsal part* is composed of the two dorsal spines, each of which is 10 lines long. The whole arrangement is the same as in the opercular spines; their slit is at the front side of the point; each has a separate sac, which occupies the front of the basal portion; the contents were the same as in the opercular sacs, but in somewhat greater quantity. A strong branch of the lateral line ascends to the immediate neighbourhood of their base.

Thus we have four poison-spines, each with a sac at its base; the walls of the sacs are thin, composed of a fibrous membrane, the interior of which is coated over with mucosa. There are no secretory glands imbedded between these membranes, and these sacs are merely the reservoirs in which the fluid secreted accumulates. The absence of a secretory organ in the immediate neighbourhood of the reservoirs (an organ the size of which would be in accordance with the quantity of the fluid secreted), the diversity of the osseous spines which have been modified into poison-organs, and the actual communication indicated by the foramen in the sac lead me to the opinion that the organ of secretion is either that system of muciferous channels which is found in nearly the whole class of fishes, and the secretion of which has poisonous qualities in a few of them, or at least an independent portion of it*.

The sacs are without an external muscular layer, and situated immediately below the loose thick skin which envelopes the spines to their extremity; the ejection of the poison into a living animal, therefore,

* This, of course, must be demonstrated by further preparations; for I would not sacrifice the single (typical) specimen, the less as we may confidently hope that Capt. Dow will furnish us with ample materials before long.

can only be effected by the pressure to which the sac is subjected the moment the spine enters another body.

Nobody will suppose that a complicated apparatus like the one described can be intended for conveying an innocuous substance, and therefore I have not hesitated to designate it as poisonous; and the greatest importance must be attached to it, inasmuch as it assists us in our inquiries into the nature of the functions of the muciferous system, the idea of its being a secretory organ having lately been superseded by the notion that it serves merely as a stratum for the distribution of peripheric nerves. Also the objection that the Sting-Rays and many Siluroid fishes are not poisonous, because they have no poison-organ, cannot be maintained, although the organs conveying their poison are neither so well adapted for this purpose nor in such a perfect connexion with the secretory mucous system as in *Thalassophryne*.

Finally, I have to add that neither *Batrachus* nor *Porichthys* has the spines perforated, and also that in *Thalassophryne* the poison-organ serves merely as a weapon of defence. All the Batrachoids with obtuse teeth on the palate and in the lower jaw feed on Mollusca and Crustaceans.

MISCELLANEOUS.

On the Naturalization of the White Hare in Faroe.

To Dr. J. E. Gray, F.R.S. &c.

My dear Sir,—The enclosed extract from a letter from my friend Mr. Müller, of Faroe (member of the Danish parliament), will explain my object in sending you one of the specimens of *Lepus variabilis*? which he mentions.

It seems a very successful case of naturalization: the species, of course, did not need acclimatizing.

Yours very truly,
W. C. Trevelyan.

Wallington, Newcastle-on-Tyne,
Nov. 9, 1864.

"In 1854 or 1855, two pairs of Hares were introduced into Stromöe (Faroe) from Norway: they have increased so rapidly that there are thousands now in the island. One may shoot twenty in a day upon the hills, and it will be impossible to exterminate them.

"I have tried several times to import the Ptarmigan from Iceland, but hitherto without success. It appears that they cannot live more than two or three days when captured. Eggs have proved unsuccessful, too, the greater part having been sat upon."

Description of Lophogaster typicus. By M. Sars.

At the present day zoologists devote their attention especially to those exceptional forms which serve to unite groups otherwise distinct. These forms, which at one time were regarded as embarrassing

systematic zoology, are now those which excite the liveliest interest. *Lophogaster typicus*, a Crustacean discovered by M. Sars on various parts of the Norwegian coast, is one of these forms.

Milne-Edwards combined the *Euphausidæ* and *Mysidæ* with the *Squillidæ* and *Amphionidæ* to form an order distinct from the Decapoda, and for which he retains Latreille's name of Stomapoda. This order is characterized by the absence of thoracic branchiæ lodged in an internal cavity. Dana has followed the same course, his orders Eubranchia and Anomobranchia being synonymous with Decapoda and Stomapoda.

These orders are not, however, so distinct as they seem at first sight. The branchiæ of certain Macrourous Decapods (*Alpheus, Hippolytes, Stenopus*) are only partially covered by the carapace; and Kröyer has shown that in the genus *Sergestes* the sides of the carapace are not sufficiently prolonged to cover the branchiæ. These exceptions sufficed to show that these two orders of Crustacea form a continuous series; but, by his description of *Lophogaster*, M. Sars has made us acquainted with a link which unites them still more intimately.

In this Crustacean the thoracic branchiæ are ramified like the posterior branchiæ of the *Euphausidæ*. The upper part of the ramification is covered by the carapace in the manner of the branchiæ of the Decapoda, whilst the median and lower branches hang down freely in the water, as in the *Euphausidæ*. Other characters, to which it is unnecessary to advert, render the relationship of *Lophogaster* to both groups still more evident; and thus it appears that the whole of the Podophthalmous Crustacea form a single natural order. The Stomapoda seem to be only degraded Macrourous Decapods—an opinion which is supported by Professor Dana. The development of *Lophogaster* is precisely similar to that of *Mysis*.—*Bibl. Univ.* Sept. 20, 1864, *Bull. Sci.* p. 87.

On a Peculiarity in the Venation of the Leaves of the Genus Fagus. By Professor A. DeCandolle.

In the ordinary condition the lateral veins of a leaf occupy the centre of the lobes, or answer to the extremities of the teeth, when the leaf has lobes or teeth. Of the rare exceptions to this rule M. De Candolle has already indicated three in a note to p. 558 of vol. ix. of his 'Prodromus,' namely, *Coldenia procumbens*, Linn., *Cratægus oxyacantha*, Linn., and the *Rhinanthi*, in all of which the secondary veins correspond with the sinuses, and not with the projections, of the margins of the leaves. In the present paper he describes the occurrence of the same structure in certain species of *Fagus*.

Of the Beeches of the southern hemisphere, two, namely *Fagus Gunnii*, Hooker, and *F. antarctica*, Forst., have the veins constantly and distinctly corresponding with a sinus; but in some cases the veins even of the same leaf, towards the extremity, run partly to the teeth and partly to the notches. This is the case in *Fagus alpina*, Pöpp. & Endl., and even in the common *F. sylvatica*; but

in the latter the teeth are so faintly marked that it is not always easy to recognize this peculiarity. When this double direction exists in a leaf, the extreme veins, which are the shortest, are straight, and clearly terminate in a tooth, just as the central vein terminates in the tooth of the extremity of the leaf. The other veins are curved near the tooth in such a manner that the nearer we approach the base of the leaf the more do the veins correspond (or appear to correspond) with the notches. The organogeny of the leaf would probably show that at first the veins of these species all answer to teeth, and that the growth of tissue alone has caused them to deviate, except at the extremity, where the leaf is less enlarged.

The direction of the veins furnishes, however, a good character for distinguishing the Japanese *Fagus Sieboldii* and the *F. ferruginea* (*F. sylvestris*, Mirb.) from the European *F. sylvatica*. Linnæus regarded the North American Beech as belonging to the European species, and in this he has been followed by some modern botanists. Mr. Bromfield, who has carefully observed the American species, admits the specific difference of the two Beeches (Hooker's Journal of Botany, 1849, p. 112); but he has not noticed the difference of the venation, which corroborates the other characters. In the North American Beech, as in the Japanese species, all the lateral veins evidently correspond in a straight line with the teeth, which are always distinct and well-marked. In the European Beech the teeth are less distinct, and often become mere undulations; and the veins are directed rather towards the notches, or at least become curved near the teeth, with the exception of those of the apex of the leaf.

The species which have all the lateral veins directed towards the teeth are, besides *F. Sieboldii* and *F. ferruginea* already mentioned, *F. obliqua*, Mirb., *F. Dombeyi*, Mirb., *F. fusca*, Hook., and *F. Cunninghamii*, Hook. Those in which all the lateral veins tend towards the sinuses are *F. antarctica*, Forst., and *F. Gunnii*, Hook. Those in which the majority of the veins are directed towards the sinuses are *F. sylvatica*, *F. alpina*, Pöpp. & Endl., and *F. procera*, Pöpp. & Endl. Lastly, in some species, which complete the genus, the teeth are wanting or very indistinct, or the veins are much attenuated, and sometimes the secondary ones become confounded with the tertiaries in a complicated network; in all these cases the direction cannot be readily ascertained. This applies especially to *F. Solandri*, Hook., and *F. cliffortioïdes*, Hook., from New Zealand, the leaves of which are entire.

The two species in which the veins most evidently alternate with the teeth (*F. antarctica* and *F. Gunnii*) belong to the section of the genus that includes those in which all the veins terminate in teeth, such as *F. Sieboldii* and *F. obliqua*, as well as our European Beech; these have the young leaf folded, in the bud, on each lateral vein. The direction of the veins is therefore a purely specific character; and this should warn palæontologists not to lay too much stress upon the details of venation as indicative of genera. Nevertheless the direction of the veins relatively to the teeth or sinuses deserves mention in the specific characters, especially of fossil species.

These diversities of venation would have appeared much more extraordinary a few years ago, before the modern observations upon the formation of the tissues of the leaf. It was then usual to speak of the veins as the *framework* of the leaves, which implied, more or less positively, the idea that they preceded the parenchyma, and that this was formed around them as about a solid point of support. We now know that every organ commences by being cellular and of slight consistence, and that the projecting parts precede the veins. Hence the woody tissues and the bones of organisms are only a consequence of the soft parts. It is, however, singular that in very nearly allied plants, and sometimes in two portions of the same leaf, the solid parts should sometimes occur in the middle of the lobes and sometimes outside of them; and it appears probable that at the actual moment of formation of the veins they would present a more constant position. Observations on the formation of leaves, and especially on the development of the veins, are not yet sufficiently numerous to lead to any conclusion upon this point. But probably it will be found that the exceptional veins, or those which run towards the lateral sinuses of the leaf, are veins which have deviated at a certain epoch, or veins which originally corresponded to a projection the termination of which has been arrested in its development, whilst the parts originally depressed have increased in size.—*Bibl. Univ., Archives des Sciences,* Oct. 1864, p. 164.

On the Development of the Flowers of the Compositæ. By Professor WOLFGANG.

The course of development, which may be observed particularly well in the common Sowthistle (*Sonchus arvensis*), is described by the author as follows:—"The flowers of the capitulum are developed after the leaves of the involucrum, in a direction from the periphery of the receptacle to its centre. The first traces of leaves appear in the form of oblique prominences, directly continuous with the epithelium of the receptacle. The future point of the flower by no means corresponds with the point of this prominence. Subsequently these commencements of flowers become perfectly hemispherical; the organic point of the bud remains behind in its growth, whilst around the apex there is formed a circular elevation, which in a short time forms a sort of crater. On the outside, a little above this annular rampart, there appear sometimes some cushion-like inflations, perhaps the commencement of the obliterated calyx. There is no trace of the pappus. Subsequently the five petals originate on the margins of the crater-wall; their increase takes place at the base, and they curve inwards successively in a geniculate form. The anthers follow these, alternating with them; they are developed on the inner slope of the crater. The petals become soldered together from the base up to the place where the lobes afterwards make their appearance. The pappus projects from the outer wall of the crater-margin, but not until the anthers have advanced considerably in their development: from its origin and its nature, it must be regarded as an accessory

organ. The ovary, which is truly inferior, is produced by a discoidal formation. The ovule is lateral. The succession of the development of the leaf-cycle is altogether abnormal.

In describing the pappus of *Sonchus*, the author remarks that its degree of fragility depends upon its state of cultivation; but it cannot yet be decided whether a stony soil plays any part. The fragility depends very closely upon the thickness of the hairs of the pappus, and this is governed by the number of rows of cells which form the hairs. In *Sonchus* the base of the pappus is formed by three or four series of cells; the oldest part of the hairs is the extremity. The very fine pappi of *Sonchus*, when examined by the microscope, present at their extremity a system of hooks, formed, on the average, of five or six cells, arranged upon eight lines, recurved externally in the form of a hatchet; these will probably hereafter furnish specific characters. The author indicates the characters thus displayed by *Sonchus arvensis, arboreus, asper, oleraceus, palustris,* and *tenerrimus*. All these species, especially the two last, most clearly show this system of recurved teeth, whilst the pappus of *Sonchus divaricatus* departs considerably from them, and more nearly approaches that of the exotic *Rhabdotheca*.—*Bibl. Univ.* October 1864, p. 169.

On the Remains of Plants found beneath the Swiss Lake-dwellings. By Professor O. Heer.

At the late meeting of the Société Helvétique des Sciences Naturelles, on the 23rd of August, Professor Heer exhibited a collection of vegetable remains found under the ancient lake-dwellings of Switzerland. In his remarks upon these remains he referred particularly to some interesting recent discoveries at Robenhausen, on the Lake of Pfäfikon. The subsoil of the layers of peat at Robenhausen is formed by a white mud; above this white mud, and also below the peat, are the vegetable remains, nearly all of which are carbonized. They are evidently the débris of plants that the former inhabitants have thrown into the lake.

The remains of useful plants are particularly interesting for the history of agriculture. Among cereals we find wheat and barley of the following kinds:—A small-grained variety of *Triticum vulgare*, Linn., occurs most frequently at Robenhausen, and also at Wangen, in the Lake of Constance, and at Moosedorf, in the Canton of Berne; a *Triticum vulgare*, with grain of the ordinary size, is also met with. These two varieties have been sent to Prof. Heer from the locality near Olmütz, the age of which is unknown. Near Robenhausen *Triticum turgidum* occurs, a species still cultivated in the south of Europe, but scarcely in Switzerland. At Wangen the *T. dicoccum* and *T. monococcum*, Linn., are known to occur; and *T. Spelta* is found only in the recent lacustrine locality of the île de St. Pierre (age of bronze?). Of barleys, the *Hordeum hexastichum*, Linn., is generally diffused. Its ears, from which the grain has fallen, are found well preserved in most of the lacustrine villages. According to Unger, this barley is also that of the ancient monuments of Egypt; whilst our common barley (*H. vulgare*) is wanting in both localities,

and is, therefore, probably a form of the first-named species produced by cultivation in the course of thousands of years. Lastly, *Hordeum distichum* is found at Wangen and the île de St. Pierre, a district in which it is still generally cultivated. Rye and oats have not hitherto been found in the more ancient habitations (of the stone age); but the *Avena sativa* has been met with in the recent locality of the île de St. Pierre, as also frequently beneath Roman ruins. The *Secale cereale*, Linn., the cultivation of which appears much later in history than that of the other cereals, and did not become general in these regions until towards the middle ages, has recently been found in the above-mentioned locality of Olmütz (age unknown), which is in support of the opinion of A. DeCandolle that Eastern Europe is the native country of rye. Lastly, millet (*Setaria italica*) has lately been found at Robenhausen: this, according to Cæsar, was the chief cereal of the ancient Helvetians, and it is still met with abundantly among Roman ruins.

Along with these ten species of cereals abundant remains of straw are found. The millet cakes found at Robenhausen, and the numerous fragments of round, flattened loaves in which grains of wheat are still recognizable, furnish conclusive evidence of the mode of preparation of food from these cereals. The grain was evidently triturated very imperfectly between plates of stone, and the dough was baked under hot stones and ashes.

The leguminous vegetables present much less variety. It is only in the more recent habitations (of the bronze age) that three leguminous plants are found; these are field-beans (*Vicia Faba*, Linn.), the common pea (*Pisum sativum*, Linn.), a variety with exceedingly small seeds, and the lentil (*Ervum Lens*, Linn.). This species appears at this time to have been diffused over a great part of Europe; for it occurs in lacustrine localities at Parma, as well as in the île de St. Pierre, the Lake of Bienne, &c.

Of fruits, two sorts of apples are found in abundance, viz., 1. a small kind, evidently wild, and 2. a larger sort, undoubtedly cultivated, which occurs sometimes entire, sometimes divided into two or three parts. Pears of a very small kind (wild) occur very rarely. At Robenhausen cherries are found, with large stones. Plums (*Prunus insititia*, Linn.), with small and smooth stones, also occur. The fruits of *Prunus spinosus* and *P. Padus*, the stones of which are frequently found, also appear to have been used as food.

In the lacustrine remains of Switzerland no traces of the vine are found; but at Parma seeds have occurred precisely similar to those of the wild vine (*Vitis sylvestris*). Thus, at the time of the lake-dwellings the vine must have been already naturalized in Upper Italy, of which it does not appear to have been a native.

Only a single textile plant is found, namely flax; and this occurs in great quantity. The seeds, capsules, and stems have been found; and flax has also been met with in cords, and a small quantity in the form of platted work and of varied tissues, which leads to the conclusion that it was an important object of industry. We know that flax also played an important part among the Egyptians. It is very remarkable that both the seeds and the capsules of the flax of the

lake-dwellers were much smaller than ours; in form and size they approach much more closely to *Linum perenne*, Linn., a species which still grows in the wild state in Germany; so that we might conclude that our common flax is a form produced by cultivation from the *L. perenne*.

A great number of remains of wild plants have also been recognized. The following species of eatable fruits and tubers have been observed :—1. Raspberries (*Rubus idæus*, Linn.) ; 2. Strawberries (*Fragaria vesca*, Linn.), of which the seeds are found in masses; 3. the Elder (*Sambucus nigra*), the berries already serving for the preparation of cakes; 4. the fruit of *Trapa natans*, which was formerly widely diffused, but is now an almost extinct plant among us; 5. a great quantity of nuts, belonging to the two forms which have been recently distinguished—*Corylus avellana*, Linn., and *C. glandulosa ovata*, Willd.; 6. seeds and leaves of the beech (*Fagus sylvatica*, Linn.), indicating the abundant use of the fruit of that tree; 7th and lastly, the peculiar tubers of a plant similar to our *Equisetum Telmateja*, Linn., which is very rich in starch, serving, no doubt, as food for the inhabitants, as it is likewise found carbonized among the grains of wheat.

Of weeds, we find at Robenhausen the carbonized capsules of a *Silene* and of the poppy (*Papaver Rhœas*, Linn.), which still occur in our country.

At Robenhausen, as previously at Meilen, much amadou (*Polyporus igniarius*) is found, and at Parma also *Dædalea quercina*. Of the conifers three have been found—the berries of the common juniper (*Juniperus communis*, Linn.), trunks or wood of the pine (*Pinus sylvestris*, Linn., and *P. montana*, Duroi) and the fir (*Abies excelsa*, DC.). Of the yew (*Taxus baccata*, Linn.) bows were made. Of deciduous trees there are, besides the hazel and the beech, the witch-elm, the oak, the lime-tree (much bast), the holly, and the dogwood.

Of aquatic plants, the seeds of *Scirpus lacustris, Ceratophyllum demersum, Potamogeton, Polygonum hydropiper, Galium, Pedicularis, Menyanthes, Nymphæa alba, Nuphar luteum*, and *N. pumilum* are found in great abundance.—*Bibl. Univ.* Oct. 1864, p. 160.

On some Norwegian Crustacea. By M. G. O. Sars.

M. Sars has made some curious observations on the persistence in the Scandinavian lakes of certain marine Entomostraca of the glacial epoch. *Harpacticus chelifer* was found in a freshwater lake in the neighbourhood of Christiansund. In the Mjœsen lake (the largest in Norway) he discovered two species of *Cythere, Mysis relicta*, Lov., and *Gammarus cancelloides*, Gerstfeldt; the two latter species were also found by Lovén in the Swedish lakes. In ponds of the environs of Christiania the Amphipod *Pontoporeia affinis* was discovered. These species all inhabit the deepest parts of the water, and live quite separate from the true freshwater forms of Crustacea. M. Sars considers the presence of these Crustacea in the Scandinavian lakes to furnish evidence that at the glacial epoch the basin of the Baltic was in communication with either the eastern or western Arctic ocean.—*Bibl. Univ.* Sept. 20, 1864, *Bull. Sci.* p. 84.

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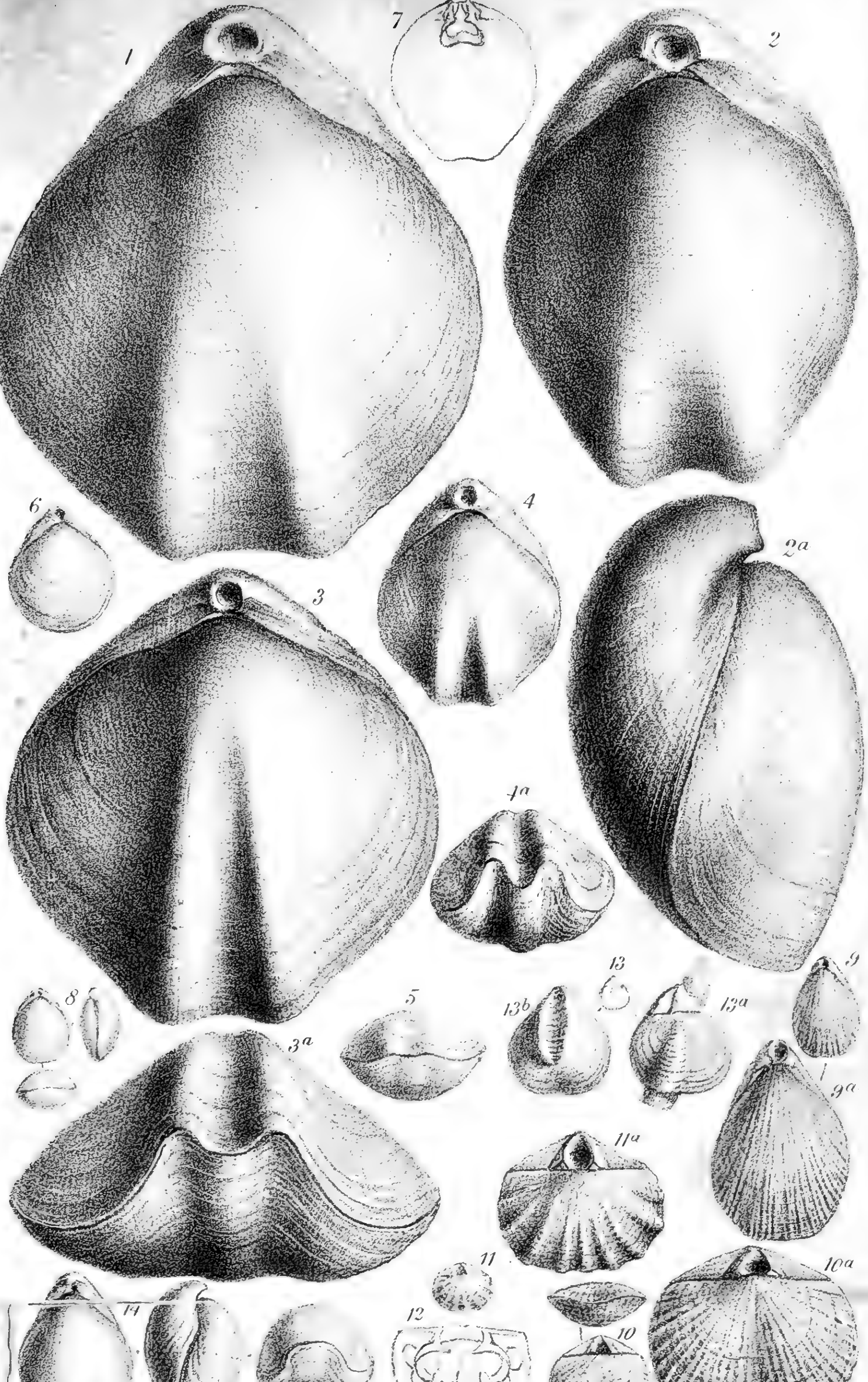

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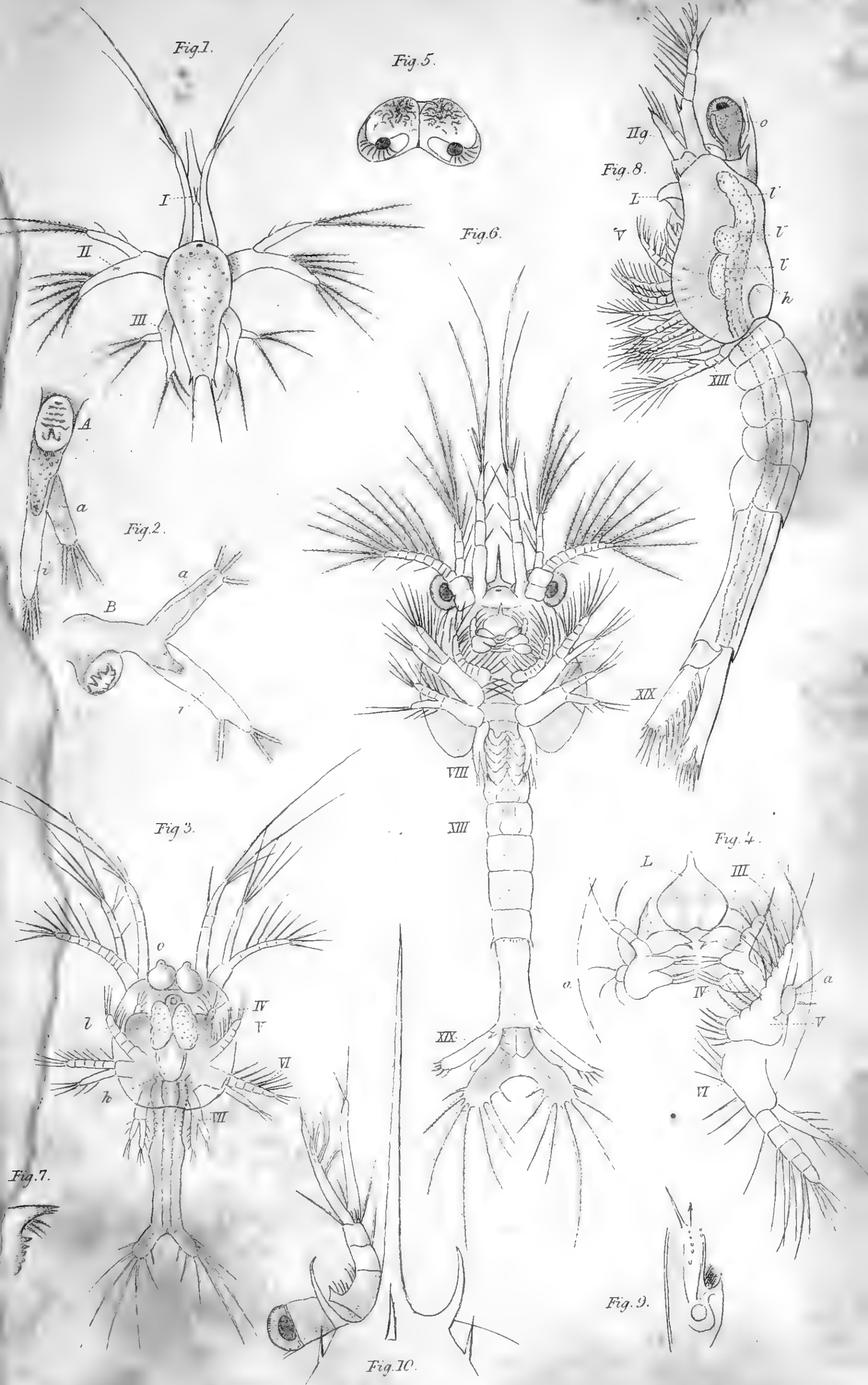

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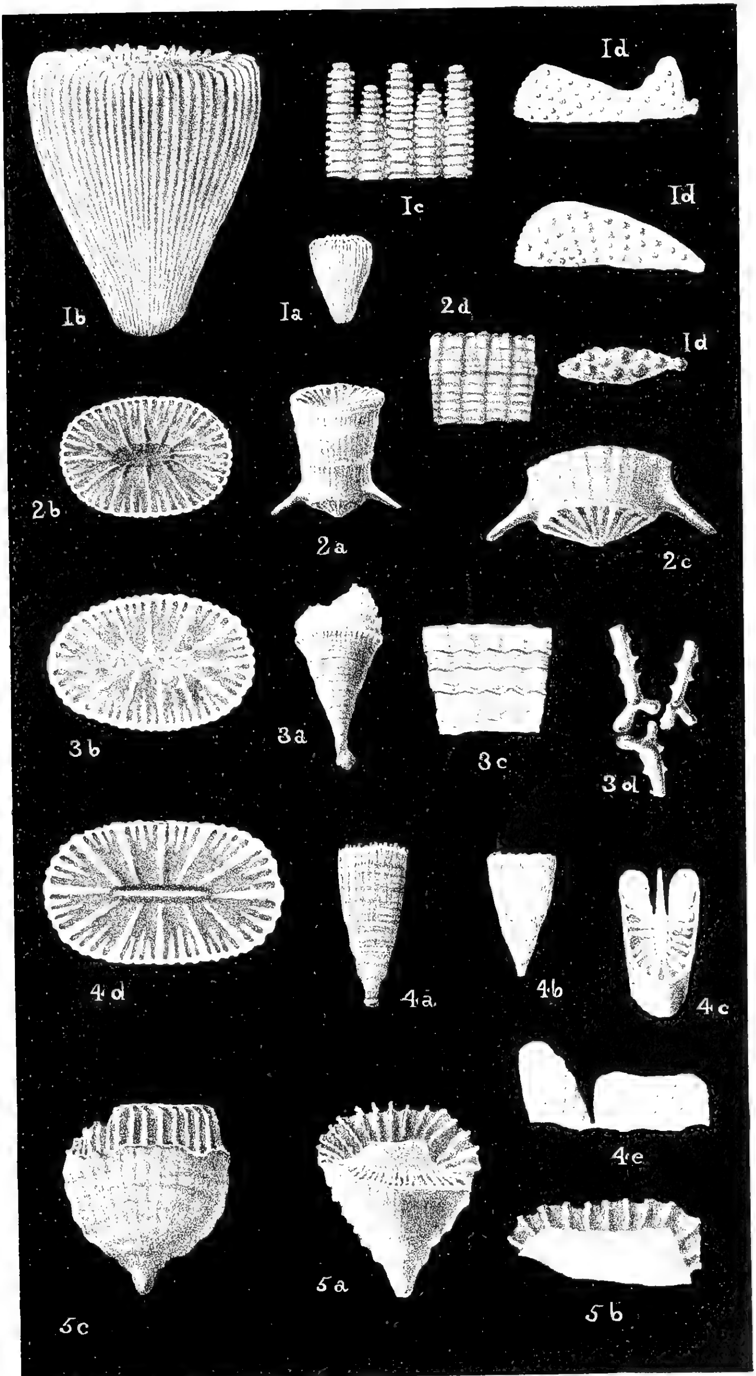

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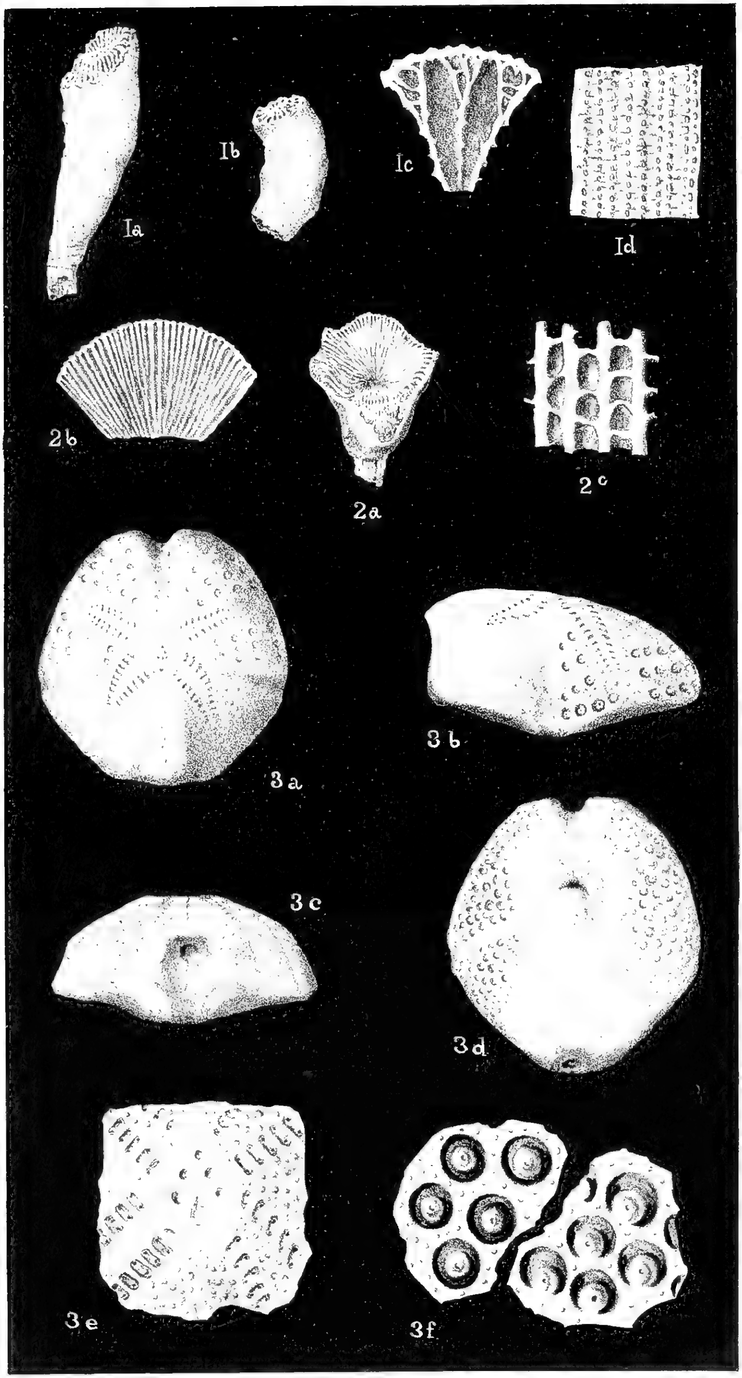
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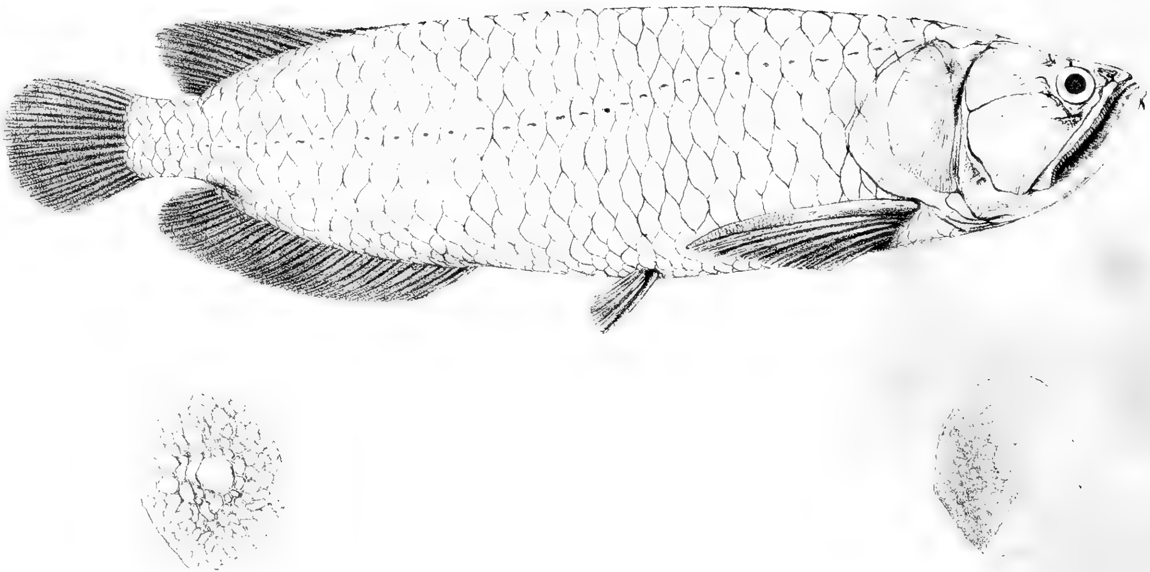

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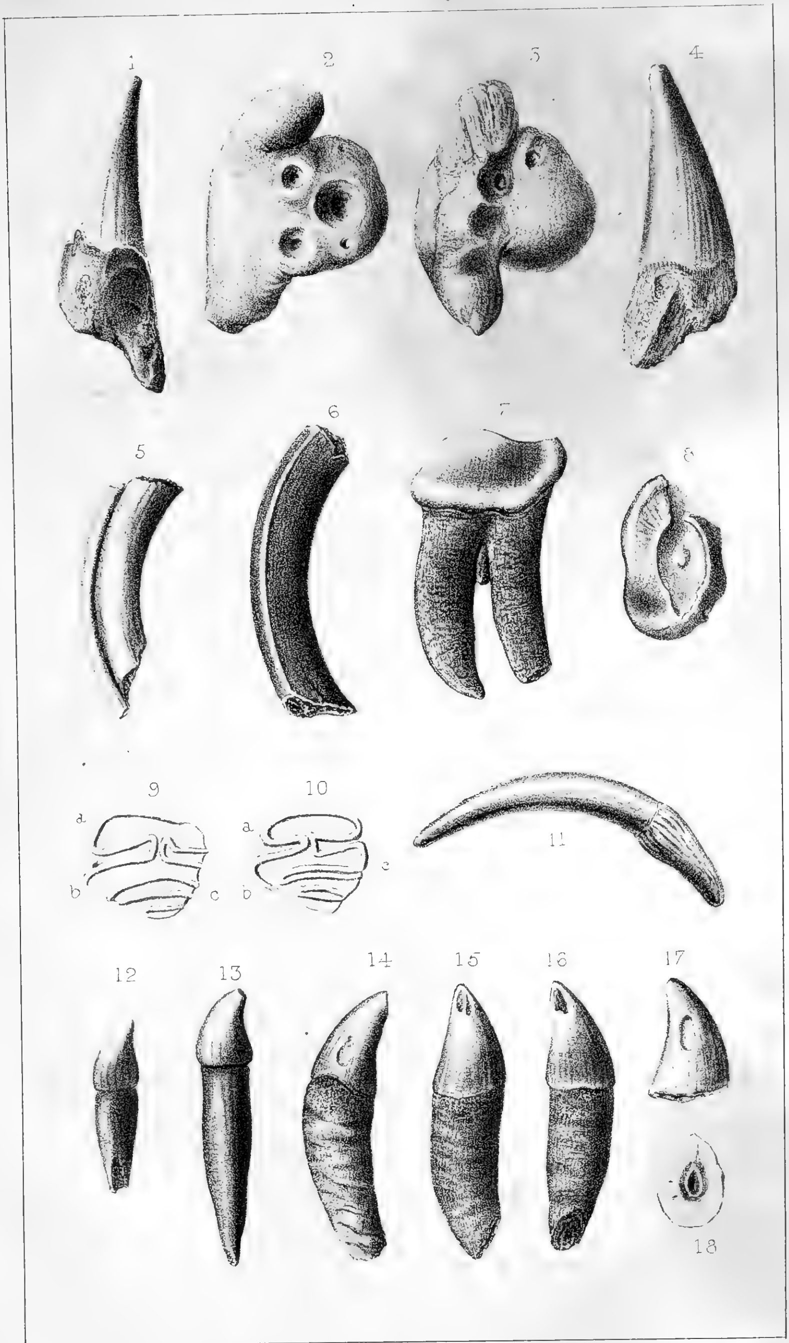

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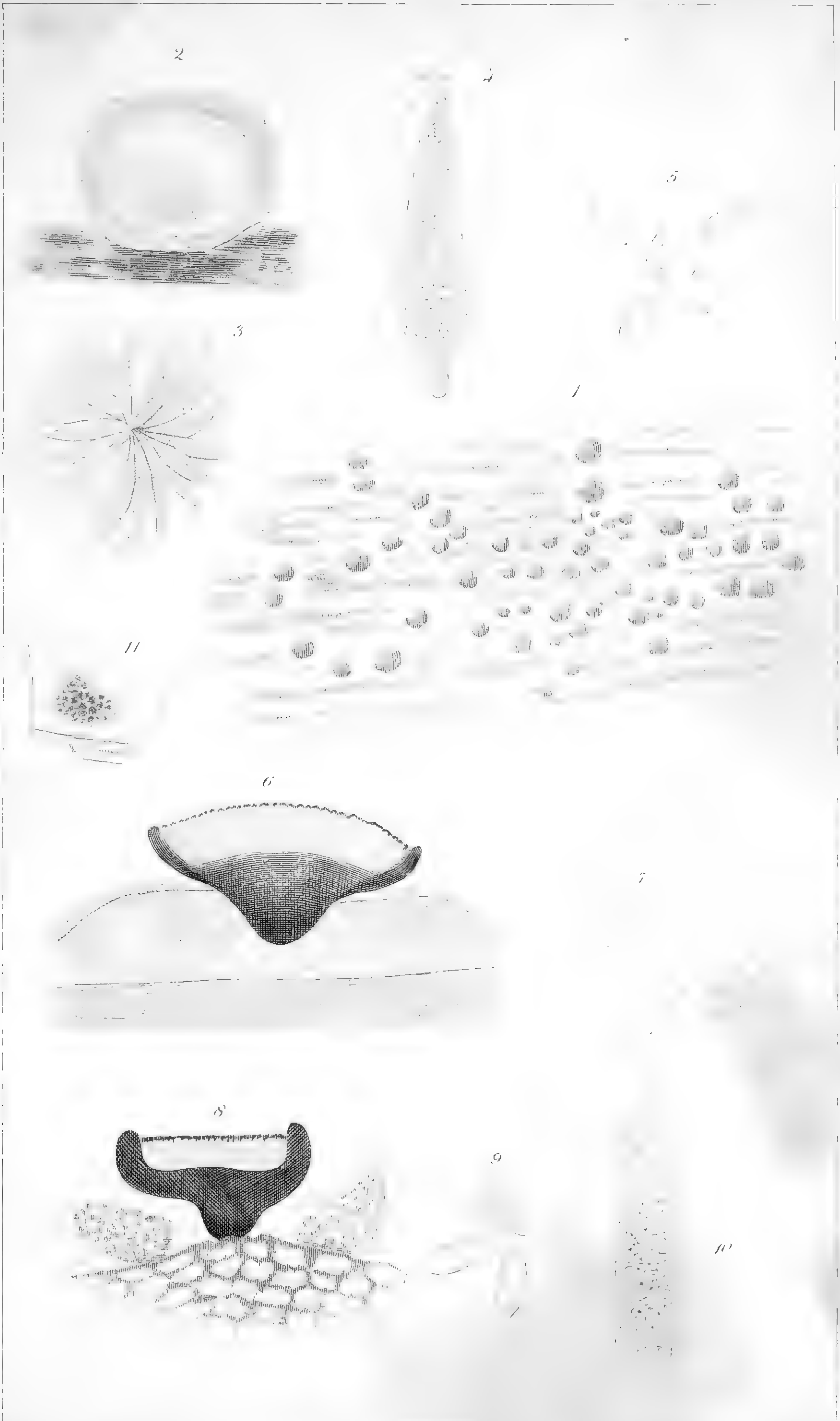

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